

LOWEST COMPONENT PRICES NATIONWIDE

PRINTER
UPGRADES

PCUPGRADE

THE GUIDE TO BUILDING AND EXPANDING COMPUTER SYSTEMS

BUILDING A 486 DREAM MACHINE

STEP-BY-STEP ASSEMBLY

HARDWARE

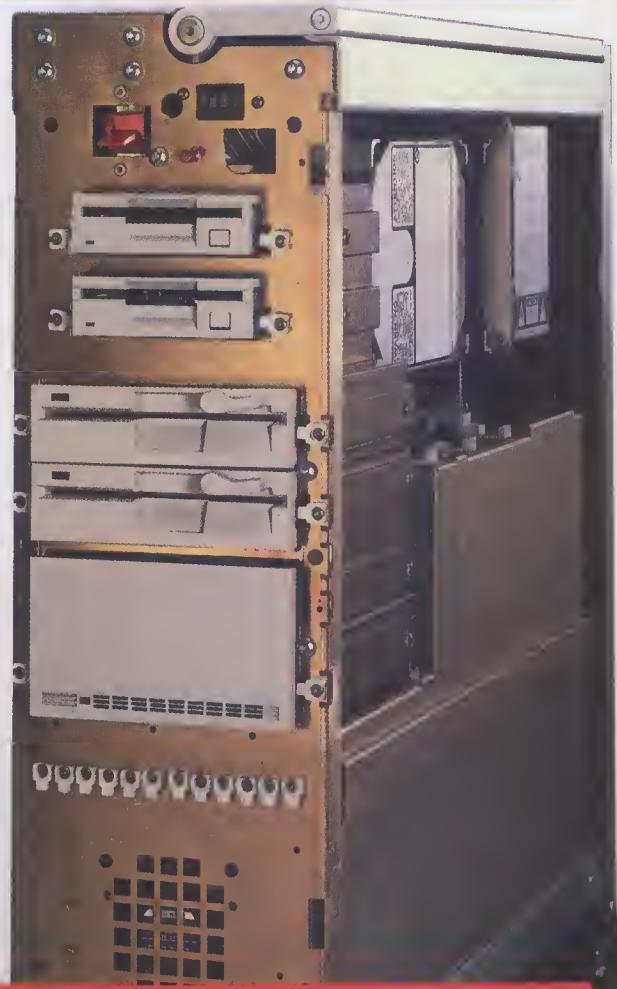
- SCSI-1 vs. SCSI-2
- Memory Upgrades
- Hard Disk Drives

SOFTWARE

- Putting DOS To Work
- 7 Top Diagnostic Utilities
- CD-ROM: Library of the Future

SPECIAL REPORT

- Multimedia Upgrade Kits
- 12 Steps To A Great Multimedia Presentation



05
K48855
U.S.
\$4.95
CANADA
\$5.95

WARRANTY HORROR STORIES!
...and how not to become one

TO BUILD OR NOT TO BUILD?



Damn good question. You've always wanted to build your own PC, but ...

What type of machine?

What if it doesn't work?

What about warranties?

Will it meet FCC approval?

Will the components work together?

Can I upgrade later?

Will I learn anything?

Does anyone speak English?

Worry no more. PC-Build specializes in computer kits and components. Our staff of system consultants will work with you to develop the machine you're looking for, at the right price.

You can't beat our services. We offer:

- A full line of FCC class B approved kits (from 386SX to 486DX/2)
- 30 day *"You Can Build It"* guarantee
- Newly revised step-by-step instruction manuals, with sections on Computer Basics and Troubleshooting
- Integrated kit building video
- 1 year warranty on parts
- Top quality components
- One of the best technical support hotlines in the business

Complete systems start under \$800. You can choose one of our standard kits or create your own machine using our custom kit option.

These are 100% compatible PCs that perform as well as (or better than) a comparably configured Compaq or Dell (Based on Norton SI ratings).

But you get more than just a fast PC. You go inside the case and learn hardware secrets by doing it yourself. Future upgrades and repairs are a snap -- after all you've built it yourself!

Call today for our free catalog!

PC-Build
COMPUTER KITS

Discover the Experience

Discovery Curve, Inc. 85 Franklin Street, Needham, MA 02194

Order/Information Line: 1-800-798-6363

Fax Information Line: (617) 449-8444

PC-Build Computer Kits is a registered trademark and trademark of Discovery Curve, Inc. All other brand and products names are trademarks of their respective companies.
This entire ad was created on a DX3000 kit with color monitor. Total hardware cost \$1199 (No kidding!).

FIX YOUR PC FAST!



**DATA RECOVERY
SOFTWARE**

RECOVER DATA FROM PHYSICALLY DAMAGED FLOPPIES & HARD DISKS IN LESS THAN 60 SECONDS!

RESCUE DATA RECOVERY SOFTWARE™ is the FASTEST, EASIEST & SAFEST method in data recovery anywhere!

For the first time you can recover a file in less than 60 seconds even when DOS cannot read the disk or drive.

RESCUE DATA RECOVERY SOFTWARE™ Version 4.0 does all the work. No more complicated time

consuming steps. No more manually reconstructing your file. **RESCUE DATA RECOVERY SOFTWARE™** does it all AUTOMATICALLY!

Recover Text, .Exe, Graphics files, etc... You can even recover entire sub-directories with a single key stroke. **CALL NOW FOR PRICING!** Some failures may be beyond RESCUE's ability to recover data.

"In the past, General Failure messages left you few options. Norton, Central Point, or Mac Utilities weren't likely to help... Now there is a better solution... RESCUE can recover data from all but the most thoroughly trashed disk... RESCUE appears to work miracles..." INFOWORLD



Version 3.0
RATED #1

FIX YOUR WINDOWS FAST!



**BEST
Windows
Trouble-
shooting
Program
Available!**

July 1993

"...a model of elegance and clarity. Skylight's detailed reports on memory and resource usage are unique and useful, a wealth of detailed information... Skylight stands out as a product that exudes intelligence in function and design." - PC Magazine 7/93



Skylight™

**TUNE, OPTIMIZE & TROUBLESHOOT
WINDOWS for optimum speed & performance through hundreds of reports!**

SKYLIGHT™ is the first true Windows troubleshooting utility written in Windows that reports information as Windows sees it! Uncover the mystery of how Microsoft Windows is using your computer's resources.

- All memory areas are displayed with a text display and graphic memory map.
- Increase performance through .INI file optimization. Safely edit any .INI file (WIN.INI, SYSTEM.INI, all 5 WordPerfect.INI files, Windows for Work Groups and Norton Desktop.INI files), CONFIG.SYS, and AUTOEXEC.BAT.
- Saves backup copies of the files it edits for easy restoring.
- Diagnose Windows from DOS Prompt even if Windows won't load.
- Detailed descriptions of hardware, CMOS, and the BIOS memory area, allowing you to troubleshoot DOS and hardware problems.
- GDI and USER heap details which aid in determining how Windows applications are performing and the resources they are using.
- Task Information screens so users can determine which programs perform the best.
- Testing of multimedia devices' output, including WAVE and MIDI devices.

"It can pay for itself with the first hour or two of time you save while troubleshooting a system." - Windows Watcher 8/92

"Unlike many other Windows snappers, Skylight does an excellent job of analyzing your PC's upper and lower memory. Its innovative help system can aid you in understanding your AUTOEXEC.BAT, CONFIG.SYS, and .INI files and Skylight does a fine job of providing a system inventory." - PC Computing 10/92

MAXIMIZE THE ADVANTAGE OF WINDOWS!
CALL NOW FOR PRICING!



The Hard Drive Kit™

EVERYTHING YOU NEED TO INSTALL, SET-UP & MAINTAIN HARD DRIVES!

DRIVE PRO™ — The all-in-one software utility for the most efficient and correct installation and maintenance of any hard drive! • Install IDE Drives in less than 60 seconds! Automatically

sets CMDS, Partitions, and DOS formats without re-booting or user intervention! • DOS Format any size drive in under 30 seconds! • Drive Table Override allows almost any BIOS to have a user definable drive type. • Drive Boot Fixer is a safe alternative to low level formatting bad IDE Drives. • No more DEBUG, FDISK, SETUP, or FDRMAT. Plus too many other features to mention!

ENCYCLOPEDIA OF HARD DRIVES™ — 3 volumes with over 1500 pages! The largest compiled reference on Hard Drives ever published!

Volume One...SET-UP GUIDE • Interface Types and Installation • Hard Drive Specs for 2100 drives from 1984 to present: Make, Model, Formatted Capacity, Data Heads, Cylinders, Average Seek Times, Form Factor, Height, Interface, Encoding, Landing Zone, Sectors Per-Track, Write Precompensation Cylinder, Reduced Write Current and Mean Time Between Failure. • BIOS Drive Type Tables • Directory of Manufacturers • The Floppy Drive Cable • Power Connector • Pin Assignments and Specifications

Volume Two...DRIVE SETTINGS • Explanation of Jumper Types, Changes in Make & Model and Default Jumper Settings • Diagrams for over 1000 drives with: Specifications, Drive Sizes, Interface Types, Jumper Settings and Locations, Terminal Resistor Locations, Pin Assignments, Pin 1 Locations, Cable Type and Locations.

Volume Three...CONTROLLERS • Over 350 Diagrams of Controllers with: Specifications, Card Sizes, Largest Head and Cylinder Sizes, Interface Type, Detailed Jumper Settings, Pin Assignments and Cable Locations. • Controller to Drive Power Connections, Drive Activity L.E.D. Connections, Common Debug BIDS Format Codes and Default Jumper Settings.

THE HARD DISK TECHNICAL GUIDE™ — Comprehensive field version of the Encyclopedia with over 400 pages of vital specs! Compact to carry in the field. **CALL NOW FOR PRICING!**

- Free Tech Support
- Performance Guaranteed
- Next Day Shipping

**ORDER DIRECT — CALL
(800) 653-4933**

800-OK-FIXED

AllMicro, Inc.

1250 Rogers St. • Suite D • Clearwater, FL 34616

(813) 446-6660 • Fax (813) 446-8075

Copyright © 1993, Rescue Data Recovery Software™, The Hard Drive Kit™, and The Troubleshooter's Kit™ are trademarks of AllMicro, Inc. All Rights Reserved. Other names are trademarks of their associated owners. Specifications subject to change.

TABLE OF

CONTENTS

DEPARTMENTS

Editorial	4
Swap Meet	6
Utility of the Month	8
Printer Upgrades	10
Fuzzy About SCSI?	12
Putting Windows to Work	14
Putting DOS to Work	16
PostScript	89
Marketplace	96

FEATURES

An Aid to Diagnostic Aids	19
---------------------------	----

This month we look at seven major programs from the three leading software suppliers of diagnostic tools: Diagsoft, Landmark Research, Touchstone Research.

12 Easy Steps to Your First Presentation	43
--	----

Once you've got your hardware together (see page 36) and you're ready to go, the question is: Go where? and How? Here's one idea.

Warranty Horror Stories	60
-------------------------	----

And how not to become one.

HARDWARE

Gearing Up For Your Multimedia Presentation	36
---	----

You can create a solid selling tool that includes sound, music and motion in your own home, just by adding a bit more to your budget and a lot more to your patience.

SOFTWARE

CDs—The New Technology Highway	48
--------------------------------	----

Once you've upgraded to a new CD-ROM Reader, it's time to go holiday disc shopping!

HOW-TO

Mr. Drucker Builds His Dream Machine	27
--------------------------------------	----

Wherein contributing editor, Dead Head and long-time HOG member finds it instructive to build a 66-Mhz, 486 system. We hope you will too.

SAVE VALUABLE DATA WITH



■ NOW DETERMINES THE LOGICAL CMOS SETTINGS OF ANY DRIVE AND AUTOMATICALLY RESETS IT!

■ REPAIRS BOOT SECTOR EVEN AFTER A VIRUS ATTACK.

■ AUTOMATICALLY SETS THE CMOS OF ANY IDE DRIVE INSTANTLY. (NO DRIVER REQUIRED)

■ AUTOMATICALLY SAVES AND RESTORES CMOS, BOOT SECTOR AND FAT FROM FLOPPY

■ MANUFACTURERS ADDRESS BOOK

■ IDE/BIOS SCANNER

■ BIOS DISK SPECS

■ PROVIDES COMPLETE SERVICE INFO

■ ALL MANUFACTURERS LISTED, PLUS COMMUNICATION SETUP.

■ DATABASE OF OVER 3200 HARD DRIVE SPECS.

■ ALL ON ONE DISK!

ALSO INCLUDED FREE

PC POCKET REFERENCE

ASCII CODES * PC MEMORY MAP * ADDRESS MAPS * IO MAPS, HARDWARE INTERRUPTS * SOFTWARE INTERRUPTS * PC ERROR CODES, VIDEO SCAN FREQUENCIES * KEYBOARD SCAN CODES, PORT AND CABLE PINOUTS * HEX CODES * HD CONFIGURATION DATA, FOR OVER 2000 DRIVES. * PC INDUSTRY PHONE BOOK, DOS COMMAND REFERENCE

TM SEQUOIA PUBLISHING © RICHARD L. CORREA



CONSOLIDATED
SOFTWARE
PRODUCTS



34650 US 19 N. SUITE 206 PALM HARBOR, FL. 34684

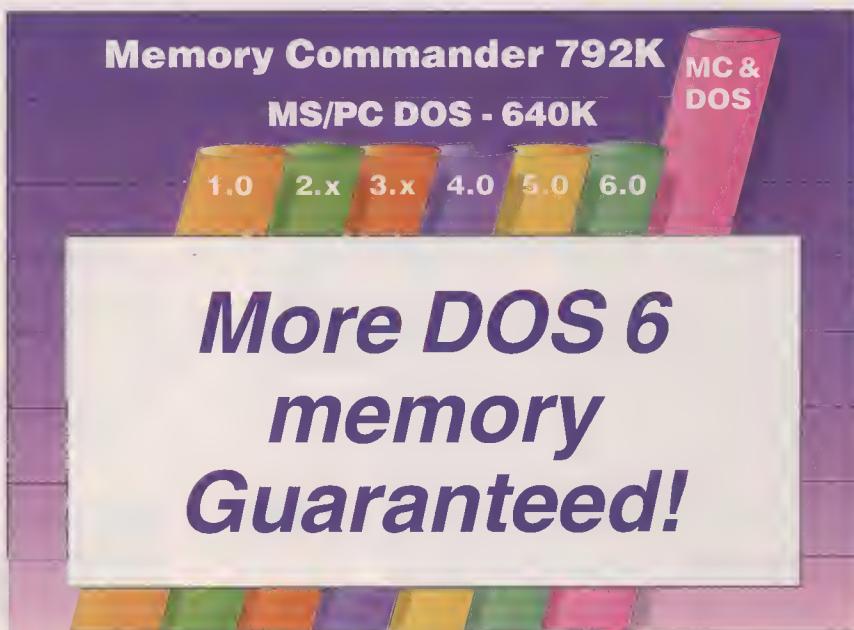
1 800 737-8763

COMPARISON CHARTS

Comparison Charts	65
-------------------	----

Comparison of Hard disk drives and CD-ROM readers, plus dealer listings and our Street Price Guide to lowest prices for Soundboards, Memory Upgrades, Software and more!

Increase DOS memory



Total conventional memory using the MEM command on a VGA, 386 or better PC.

with Memory Commander!

"... Memory Commander delivered 792Kb at the DOS prompt; miles ahead of the competition." "Wow!" Fred Langa BYTE

Every independent test proves Memory Commander delivers the most available DOS memory of any memory manager! That includes the memory managers in DOS 5 & 6.

But, the best news is that Memory Commander's memory management services are completely automated. You do NOT need a memory guru to load and use it!

Memory Commander automatically loads network drivers, TSRs and device drivers high

and optimizes high RAM. It does this without those confusing changes to your CONFIG.SYS and AUTOEXEC.BAT files. Then unused high RAM is added to conventional, low DOS resulting in the most available memory possible.

No other memory manager can do this, it's a Memory Commander exclusive! If you want to push the 640K ceiling up, only Memory Commander does it.

Memory management was introduced in DOS 5 and improved in DOS 6. But, every version of DOS has one thing in common - the dreaded 640K barrier! Want another 50-150K? Order Memory Commander now, risk FREE!

Save \$50.00 - Competitive Upgrade!

To get more memory than with your current memory manager (incl. DOS 5/6) order our competitive upgrade for just \$49.95!

If you don't have a memory manager and want to start with the best, order Memory Commander for \$99.95.



V Communications, Inc.
4320 Stevens Creek Blvd, Suite 275-UP
San Jose, CA, 95129; FAX 408-296-4441

800-648-8266 or 408-296-4224

U.S.A. shipping \$6, Can & Mex \$10, Other \$18
CA res. add sales tax. VISA/MC/AMEX

Memory Commander is the best. If, for any reason, you don't agree, return it within 60 days of purchase for a full refund.

For all MS/PC DOS 3.3 to 6.0 with 512 Kb or more of extended memory on 386 - 486 and Pentium PCs. Compatible with Windows 3.0 & 3.1, VCPI, VDS & RSIS. Provides complete pooled EMS and XMS services.

FROM THE EDITOR

Building Tips

This month one of our editors will delight you with tales of what he went through while building his own PC. I thought I would add a few tips that you won't find in his instructive article.

Dealing with Frustration

Invariably, when building your own system, you're going to run into a wall. Nothing will work right. The memory won't be recognized, the hard disk won't access data, and you'll probably be told by the system setup menu that you have a 286 processor running at 6 MHz.

Most likely, all of this is due to a combination of user error, poor documentation, and technology that has not yet matured. The best advice we can offer: Do it again. Go back to the last point at which everything worked, before you added something new. If you put in extra memory, take it out. (Quick aside: I recently added an additional 4Mb to my system, switched on the PC again and, lo and behold, no video. Took out the additional SIMMs, video comes back; put 'em in, no video. Still haven't solved that one.) If it was a new video board, put back the old one. And even if you think you installed everything correctly, take it out and do it again. I'm telling you, there is a magic to this stuff, and sometimes the same process will work the second or the third or the fourth time.

You're Not Alone

Bug every technical support person whose phone number you can get your hands on. In a column written six months ago, I told you about trying to get sound from my new multimedia system and how I called the Sony tech support line, the Grolier tech support line, and the Creative Labs (Sound Blaster) tech support line. Everybody blamed someone else, but somewhere between those three gents a few pearls of wisdom were imparted, and I now have sound. Go forth and do likewise.

Don't Work When You're Tired

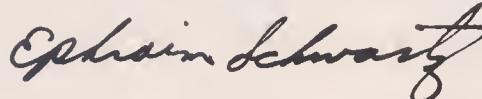
Many of you will be putting your systems together after your regular nine-to-fiver. You'll probably be starting out pooped. Take a breath and set a manageable single goal for the evening. When you're tired you invariably forget a DIP switch setting, seat a board poorly, or—heaven forbid—plug a board in with the power still on.

If you're too tired, drain your brain instead. Watch the boob tube. *Seinfeld*'s pretty good. Once in awhile, Larry King has a good interview. Or there's always the news to cheer you up.

Police the Area

Work in a clean, well-lighted place. It really helps. Be organized even if it's against your nature. Remember, one night, when everyone else is asleep and you're all alone with your magnificent home-assembled PC, you'll switch on the power, the hard disk will gurgle and groan, the monitor will crackle, the system BIOS will check itself out, the POST (Power On Self Test) will say A-OK and suddenly you'll be bathed in the bluish light of technology.

Enjoy it, but remember, five minutes from now it may all go up in smoke!



EPHRAIM SCHWARTZ
EDITOR-IN-CHIEF

PC UPGRADE

THE GUIDE TO BUILDING AND EXPANDING COMPUTER SYSTEMS

EDITORIAL DIRECTOR/EDITOR-IN-CHIEF

Ephraim Schwartz

MANAGING EDITOR

Janice Rosenthal

SENIOR EDITOR

Edward Schneider

EDITOR/

PRODUCT UPDATE FACILITY

Ruby Ho

ASSOCIATE EDITOR

Christopher Bonanos

ASSISTANT EDITOR/PRODUCTION

Peter Rossow

ART DIRECTOR

David A. Finck

CONTRIBUTING EDITORS

Jack Allweiss • David Drucker

Paul Ferrill • Jules Gilder

Reid Goldsborough • Ted Needleman

Joseph Peschel • Hillary Rettig • Peter Ruber

PRODUCTION COORDINATOR

Noreen Teichner

EDITORIAL ASSISTANTS

Judy Hutson • Julia McEvoy

CIRCULATION MANAGER

Robert Mitchell

ADVERTISING SALES

DIRECTOR OF ADVERTISING

Mary Henry Wohlberg

REGIONAL MANAGERS

Carol Berman • Yvonne Pettus

ADVERTISING ASSISTANT

Christina McFadden

PUBLISHER

Edward D. Brown

BEDFORD COMMUNICATIONS, INC., ROBERT D. HERFORD, Chairman of the Board; EDWARD D. BROWN, President; EPHRAIM SCHWARTZ, Vice President; JAY ANNIS, Vice President; HENRY SWERGOLD, Secretary.

Volume 2, No. 5, 1993 copyright. PC Upgrade is published six times per year. Subscriptions are available for \$22.50 per year from Bedford Communications, Inc., 150 Fifth Avenue, New York, NY 10011. Second class postage rates are paid at Mt. Morris, IL and additional offices. POSTMASTER: Address changes to PC Upgrade, P.O. Box 444, Mt. Morris, IL 61054-7800.

Known office of publication KableNews/Publisher's Aide, 308 East Hitt St., Mt. Morris, IL 61054. Subscription correspondence should be sent to PC Upgrade, P.O. Box 444, Mt. Morris, IL 61054-7800 (1-800-877-5487).

Address all editorial correspondence to the editor at PC Upgrade, c/o Bedford Communications, 150 Fifth Avenue, New York, NY 10011 (212-807-8220). Unacceptable manuscripts will be returned if accompanied by sufficient first-class postage. Not responsible for lost manuscripts or photos. This publication may not be reproduced in whole or in part by mimeograph or by other means without permission of the publisher.

PC Upgrade and Bedford Communications, Inc. have made every attempt to verify the accuracy of product and pricing information obtained from manufacturers and/or their agents appearing in this issue. However, PC Upgrade and Bedford Communications, Inc. do not assume any responsibility for the accuracy of said information. Printed in U.S.A.

We look terrific in basic black...



November 24, 1992
NX-2430 Multi-Font



but you'll find us equally stunning in color.

THE ALL-NEW STAR SJ-144: Star's achievements are impressive in black and white. But it's in full color that they really dazzle. Now this same brilliance can be brought to your documents at an incredibly affordable price with the full color, laser-quality Star SJ-144.

Star's all new SJ-144 produces vibrant color images far better than any ink jet. And the SJ-144's black and white print quality is so sharp and clear, it actually exceeds the resolution of most laser printers by 20%. In fact, the SJ-144 is more than a match for most any laser printer in every area but one: price. At a MSRP of just \$599*, the SJ-144 offers greater value than any other printer available today. For a free product brochure and the dealer nearest you, call 1-800-447-4700.



star

Color. Quality. Price.

*Dealer price may vary.

It's All Happening at the Swap Meet

Sunday

Monday

Tuesday

Wednesday

Thursday

Friday

Saturday

October

17

October 17, 1993

MIT Electronics Research Society,
Albany & Main St., Technology Square,
Cambridge, MA. 9:00am-2:00pm
Our LAST SHOW of the season!!
Don't miss it!! (617) 253-3776

MarketPro Computer Shows and Sales
Antelope Valley Fairgrounds
Lancaster, CA 10:00am-5:00pm
Admission Is \$6 To All Shows

MarketPro Computer Shows and Sales
Centre Concord, Concord, CA
10:00am-5:00pm
Admission Is \$6 To All Shows

24

October 24, 1993

MarketPro Computer Shows and Sales
Sonoma County Fairgrounds, Santa
Rosa, CA 10:00am-5:00pm

MarketPro Computer Shows and Sales
Del Mar Fairgrounds, Del Mar, CA
2 Big Days! 10:00am-5:00pm

31

October 31, 1993

KGP Computer Show
Fairleigh Dickinson University,
Hackensack, NJ - Rothman Center -
500 Tables!! Route 4 to Hackensack
Ave. So., left at Temple Avenue.
10:00a.m. - 3:00p.m.

MarketPro Computer Shows and Sales
California Expo Center
Sacramento, CA Admission Is \$6
To All Shows, 10:00am-5:00pm
For Further Information on These
Shows Please Call (415) 388-8893

16

October 16, 1993

MarketPro Computer Shows and Sales
Ventura County Fairgrounds,
Ventura, CA 10:00am-5:00pm

MarketPro Computer Shows and Sales
San Mateo Expo Center
San Mateo, CA 10:00am-5:00pm

Admission Is \$6 To All Shows,
For Further Information on These
Shows Please Call (415) 388-8893

14

15

16

23

October 23, 1993

MarketPro Computer Shows and Sales
Solano County Fairgrounds, Vallejo, CA
10:00am-5:00pm

Admission Is \$6 To All Shows - FREE
with membership!

MarketPro Computer Shows and Sales
Del Mar Fairgrounds, Del Mar, CA
2 Big Days! 10:00am-5:00pm

30

October 30, 1993

KGP Computer Show
Fairleigh Dickinson University,
Hackensack, NJ - Rothman Center -
500 Tables!! Route 4 to Hackensack
Ave. So., left at Temple Avenue.
10:00a.m. - 4:00p.m.

6

November 6, 1993

KGP Computer Show
Fort Washington Expo Hall - Fort
Washington, PA Over 1,000 Tables!!
PA Turnpike Exit #26 - 1/4 mile, then
right at light - follow signs
10:00a.m. - 4:00p.m.

And here's a calendar of upcoming computer shows and swap meets.

October, 1993

— November, 1993

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
14	15	16	17	18	19	20
7 November 7, 1993 Ham Radio & Electronics Swap Meet Las Positas College, Livermore, CA 7am-12pm North off Hwy 580 at Airway Blvd. exit, Follow signs. (510) 447-3857 KGP Computer Show Fort Washington Expo Hall - Fort Washington, PA Over 1,000 Tables!! PA Turnpike Exit #26 - 1/4 mile, then right at light - follow signs 10:00a.m. - 3:00p.m.	13 November 13, 1993 KGP Computer Show Raritan Center Expo Hall, Edison, NJ - 1,200 Tables!! NJ Turnpike, Exit #10 - Right turn after toll - Always a sellout!! MarketPro Computer Shows and Sales San Mateo Expo Center San Mateo, CA 10:00am-5:00pm Admission Is \$6 To All Shows	14 November 14, 1993 KGP Computer Show Raritan Center Expo Hall, Edison, NJ - 1,200 Tables!! NJ Turnpike, Exit #10 - Right turn after toll - Always a sellout!! MarketPro Computer Shows and Sales Sonoma County Fairgrounds, Santa Rosa, CA 10:00am-5:00pm	20 November 20, 1993 KGP Computer Show Wilmington, MA - Shriner's Auditorium Near Boston - 500 Tables I-93 Exit #39, North of I-95 - Replaces Woburn Show - Great New Hall!!	26 - 27 November 26 - 27, 1993 Friday and Saturday! KGP Computer Show South Jersey Expo Center, Pennsauken, NJ - Cherry Hill Area - Brand New Hall! - NJ Turnpike Exit #4 Fri., Noon - 6:00p.m. Sat., 10:00a.m. - 4:00p.m.	27 November 27, 1993 MarketPro Computer Shows and Sales Solano County Fairgrounds, Vallejo, CA 10:00am-5:00pm Admission Is \$6 To All Shows - FREE with membership!	28 November 28, 1993 MarketPro Computer Shows and Sales Scottish Rite Center Sacramento, CA 10:00am-5:00pm - and - Antelope Valley Fairgrounds Lancaster, CA 10:00am-5:00pm

Each month PC Upgrade takes a look at a unique software package to assist end users in configuring upgraded systems.

Font Managers

If you're a Windows user — and these days, most PC owners fall into that category almost by necessity — it's almost certain that you've got dozens, if not hundreds of fonts cluttering up your hard disk (and, perhaps, your documents). It seems that any software package selling for more than \$100 comes bundled with at least a few "bonus" fonts, thrown in to sweeten the deal. Bigger programs will often include entire font libraries: Micrografx Designer comes with a "Designer Collection" of nearly 200 high quality Type 1 PostScript fonts, while Corel Draw 4.0 is delivered with 750 fonts in both TrueType and Type 1 format. Clearly, it's very easy to assemble a nearly unmanageable font collection with virtually no effort at all!

Fortunately, the means to manage even the largest collection is readily available, in the form of four inexpensive programs designed solely for that purpose. Two are commercial, and two are shareware, which means that you can download them from various on-line services, such as Compuserve, and after a trial period send a modest check to make your copies legal.

Keeping It All WYSIWIG

As you may know, WYSIWIG is an acronym standing for What You See Is What You Get. It means that the

document delivered by your printer will look pretty much like the one that appears on your screen. Windows 3.1's built-in TrueType font system provides that benefit automatically, when TrueType fonts are selected for a document. But if you have a collection of PostScript Type 1 printer fonts, you'll need a program called Adobe Type Manager to generate matching screen fonts.

But before a PostScript font may be seen on screen, or used by the printer, it must be installed into the various printer drivers described in the WIN.INI file. Adobe Type Manager performs this task as well. ATM is available commercially, but is also included with many applications, including WordPerfect for Windows. Since ATM isn't application-specific, the "free" copy you get as part of a bundle will work just fine with all of your Windows programs.

Too Many Fonts?

The more fonts you install in Windows — be they TrueType, PostScript, or both — the longer it takes to load, and the slower your applications will run. That's the trade-off for having a large number of fonts available at all times. The alternative is to dynamically manage your font library, installing fonts as you need them, and removing them when you're done. This can, unfortunately,

be a very cumbersome process, especially if you use a combination of TrueType and PostScript fonts. Fortunately, it can also be a very simple process, if you purchase Ares Software's FontMinder.

This exceptionally clever program provides a means to quickly add or remove fonts or groups of fonts to or from any installed printer driver. FontMinder's font displays all the TrueType or PostScript fonts on your hard drive. A second list shows all of the fonts installed in the selected printer driver. To install a font, you simply drag it from the master list to the driver list. To remove one, drag it from the driver list to the trash can. (Doing so doesn't remove it from the master list or the hard disk; only from that printer driver.) FontMinder takes care of modifying the WIN.INI file and, if necessary, any relevant Adobe Type Manager files.

Although FontMinder takes over the installation chores from Adobe Type Manager, it doesn't replace that program. Rather, it simplifies one aspect of ATM's operation. ATM must still be on the system to provide WYSIWIG operation with PostScript fonts. In addition to allowing font-by-font modifications to be made, FontMinder allows groups of fonts to be collected into Font Packs, which are displayed by name in a third list. Once a Font Pack has been defined, dragging it into the printer driver

loads all of the fonts in the Pack into that driver. This is an exceptionally easy way to make sure that all of the fonts needed for a given project will be available in an application's font menu, without having to keep every possible font installed at all times.

Knowing What You Have

There will, no doubt, come a time when your typeface collection will contain more than one version of the same font. One reason for this that different companies call similar-looking (or even identical) fonts by different names. A typical example is Helvetica, which might also be called Swiss and HLV. You might also wind up with TrueType and PostScript versions of the same font. For the sake of convenience, not to mention disk space, it's a good idea to identify these duplications and remove all but one version of each typeface. The

problem is, more often than not the similar faces don't have similar names.

Along the same lines, it's probably not necessary to keep more than three or four of each type of text typeface.

The key to this aspect of font management is knowing what you have, and two shareware programs — Fonter and Printer's Apprentice — combine to provide a wide range of on-screen and printed samples of all installed PostScript and TrueType fonts. Indeed, either one of them is sufficient to provide the requisite information, but since each is only \$20 we'd recommend keeping both. Each offers enough unique features to make owning both worthwhile.

Printer's Apprentice can print eight different sample sheets, along with inventory sheets in several formats. A batch-print option facilitates the quick printing of sample or inventory sheets of several selected fonts. Cus-

tom headers and footers may be added to any sample sheet, and several allow you to insert your own sample text. A floating toolbox provides a quick-access alternative to the standard drop-down menus. Fonter offers similar functions, with somewhat different display modes. Particularly useful is the keyboard display, which can be very useful in determining where the various characters of clip art fonts — such as those in the splendid Agfa Discovery Font Pack — are to be found.

Unlike many shareware programs, Fonter and Printer's Apprentice are robust: over the course of our tests neither caused any trouble, and both operated as per their authors' claims. ■

Company Featured

Ares Software
P.O. Box 4667
Foster City, CA 94404
(415) 578-9090

FANTMSINK

AVOID SYSTEM LOCK-UPS, HALTING, AND DATA CORRUPTION.



Actual size

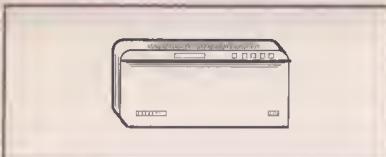
Only 1/2" high and less than 2" square, Nidec's FANTMSINK* Model 1 has the cooling power to allow 486, 68040 and other microprocessors to run at *ultra-low* operating temperatures with virtually no noise.

The world's first integral heat sink and fan, FANTMSINK mounts directly to most computers, even laptops. Only \$39.95 plus shipping. VISA/MasterCard

Nidec

Phone (800) 746-4332, (800) 74-NIDEC

* Patent Pending



Printer Upgrades

by Peter Ruber

Printer sharing becomes a snap with Primax's modular solutions.

Dial-A-Printer

Linking multiple computers to multiple printers in workgroup or network enterprises has always challenged IS managers and users alike. Print servers in networks not only become bottlenecks during peak traffic conditions, but adding printer power takes time. Network resources must first be reconfigured and workstation access rights have to be assigned.

Non-networked workgroups are similarly constricted. While there are now several reasonably-priced "intelligent" switch boxes on the market, there are limits to the number of computers and printers that can be connected, as well as limits on cable length. Users in both environments would probably like to have a printer all to themselves, but that's an economic nightmare IS managers won't even consider.

PrinterNET from Primax Electronics might just be the solution you are looking for. It's highly flexible and works equally well with existing networks and non-networked environments. Best of all, installing a PrinterNET system is no more complicated than adding extension telephones in your home.

PrinterNET allows up to 16 computers to share as many as six different printers. The hardware consists of intelligent nodes called the Com-



Utilizing common telephone-type modular cabling, PrinterNET allows the interconnection of 16 or fewer computers with up to six printers. The compact interface units plug directly into the computer and printer parallel interface ports for easy sharing of printer resources.

puter Interface and the Printer Interface which plug into the parallel ports of the respective boxes. These nodes are then connected by standard 4-conductor telephone wire with RJ-11 modular plugs, a scheme that supports a transmission loop of up to 1200 feet.

Making The Connection

The quickest and simplest method of connecting all nodes is to daisy-

chain them because there are two RJ-11 modular jacks on each unit. It does, however, result in a lot of exposed wires that might be difficult to conceal in some situations. Alternately, the bus (trunk) topology is a more sophisticated approach but requires installing modular wall jacks (along with splitters and couplers) and interconnecting them with telephone cables. This might be the preferred method if the system is likely to remain in place for the

foreseeable future. The daisy-chain and bus methods can be mixed together if you have to add computers and printers at a moment's notice. All you have to do is splice into any jack in the system with the appropriate modular coupler, and plug in the cable.

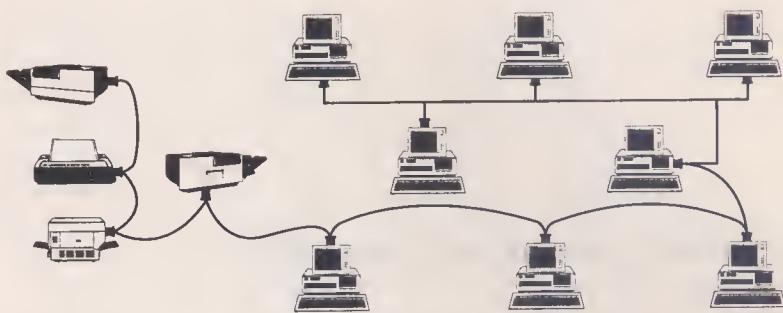
How It Works

There are two ways to implement print jobs. One method is to use the PrinterNET software; the other is to do it manually through an optional hand-held controller. The PrinterNET software is a breeze. Both DOS and Windows versions are provided on dual media diskettes. Each requires about 130K of disk space. Printer commands can be made from the DOS prompt by either entering the PrinterNET program and making several quick menu selections, or by a command line statement.

The most convenient way, however, is to load the software as a TSR program (because it only takes up about 50K of memory) and hot-key into a pop-up window. That way it's always at your fingertips. To create the same ease of use under Windows, you drag the PrinterNET icon onto the desktop. Once installed, you click on the icon and the software works much the same as the DOS version.

Your computer knows which printer you select for your hard copy output through a numbering system. A dial on the back of each printer receiver node lets you assign any number from 1 to 6. You direct printer output by selecting the printer's number from the pop-up menu, or you can assign a name to it (such as laser, color, matrix, etc.) during software installation. Printers accept output on a first-come, first-served basis.

The PrinterNET Control software employs proprietary collision avoid-



A typical PrinterNET installation. Computers on top of illustration are connected via a bus topology, while the lower ones and the printers are daisy-chained, reflecting both permanent and mobile connectivity.

ance technology to maintain data integrity. A DIP switch on each printer transmitter node lets you set form feeds as well as a time-out sequence of 5 to 20 seconds. When the time-out sequence is reached, the computer-printer connection is terminated and the printer is free to accept the next print job on the line.

Primax's hand-held controller unit, which plugs into the computer transmitter node, allows you to bypass the PrinterNET software completely. Printers are selected through a numbered dial. Users simply initiate print jobs as though they had a dedicated printer and the transmitter node feeds the data to the selected printer. In most cases, the transmitter nodes are powered through the bus. If a particular system cannot supply the minimal voltage it takes to power the nodes, Primax can supply AC adapters.

Primax has been a major OEM supplier of computer peripherals and telecommunication products for nearly a decade, is now marketing several products under its own name. In addition to PrinterNet, the company also manufactures ModularLINK, a simple and transparent interconnection of 16 or fewer computers with a single printer. Primax originated the concept of telephone wire-based shared printing resources

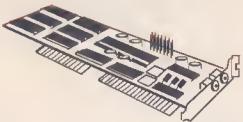
with ModularLINK in 1989 and was recently awarded a patent on the technology. The company produces a variety of electronic printer switch boxes as well.

PrinterNET is one of those rare products that work as advertised right out of the box. We connected four PCs (on an InvisibleLAN network) with two different laser printers in a matter of minutes, loaded the software, and launched a variety of printing chores without encountering even minor problems or conflicts. We also tried the hardware-only approach using the hand-held controllers.

A PrinterNET Starter Kit containing two computer transmitters, one printer receiver (with software), and two 25-foot lengths of RJ11 cable, retails for \$199.95. Additional computer transmitter and printer receiver nodes retail for \$85 each. The hand-held controller is \$45. ■

PrinterNet

Primax Electronics
254 East Hacienda Avenue
Campbell, CA 95008
(800) 338-3693



Fuzzy About SCSI?

By Jack Allweiss

Cabling and Compatibility

This month I want to discuss two topics that are basic to SCSI technology, cabling and SCSI versus SCSI-2. While cabling is normally a very mundane subject, proper cabling is crucial to a successful SCSI installation. It is also important that you understand what guidelines manufacturers must follow when they refer to their products as being SCSI-2 compatible.

There are two types of cables used in SCSI technology. The first is called internal cabling. This refers to the devices you use inside your computer chassis. The other is called external cabling, which refers to those you attach externally to the computer and are separate, enclosed devices.

There's a 50-pin ribbon cable standard followed by all manufacturers of internal cabling. Its name is derived from the way it looks. The cable has what looks like a ribbon with 50 pins and a keyed connector. Virtually all controllers have a 50-pin connector on them. The higher quality SCSI controllers use gold connectors with a housing, such as a plastic shroud, to insure that the cable is plugged in the proper orientation. The 50-pin ribbon cable will have one or more connectors for plugging in your SCSI peripherals. One end plugs into the SCSI controller, the other end plugs into one or more SCSI peripherals.

In the PC environment, most people use the internal device and connector

because it saves the cost of an external enclosure and it keeps everything in one system box for simplicity. SCSI devices come with instructions on how to mount them and they have standard connectors on them for hooking into the power supply of the PC.

However, some people do use external cabling. When SCSI was originally defined the personal computer business was not considered. The cable that was defined in the original SCSI specification was a large style cable. Some manufacturers adopted this cable. Many did not like it because the cable was very wide and the slots on the back of the PC are narrow, thus making it difficult to install and secure the cable into a PC. Some manufacturers have made special brackets to get around the problem.

Another external cable used on PC SCSI controllers is the Apple cable. When Apple came out with the Macintosh, the engineers didn't use the large SCSI cable because it was just too big for the small Apple Macintosh. So, they designed a smaller 25-pin connector. It is very similar to the connector that was used on the original PC for the serial ports. The advantage in using a 25-pin connector is that it's small, easy to plug in and very available. The 25-pin cables are relatively inexpensive and they're readily available due to the wide acceptance of the Macintosh.

The disadvantage of the Macin-

tosh cable is that it was designed during the early days of SCSI where data rates were relatively slow (1-2Mb per second). Today, we have disk drives going 10Mb per second, and the 25-pin cable is not suitable for this high speed operation.

There is a third type of connector that has been introduced along with the new SCSI-2 standard called a high density 50-pin connector. It's small, but carries all the signals and ground. This cable is unique in that it has a fastener that doesn't require screws or bailing hooks. Rather, it uses a snap-in connector, convenient for people who have to reach around to the back of a computer when there's not much room to do so. The 50-pin SCSI-2 cable has gained wide acceptance in the industry. Used on virtually every workstation computer, this cable is of high quality and is designed for very reliable operation.

Make sure that your cables have connectors that match those on the SCSI controllers and SCSI peripherals that you are using. If you have a controller with a 25-pin connector and a peripheral with a 50-pin connector, you will have to get a special cable or connector adapter.

A final point: External cable lengths are critical. When using external SCSI peripherals, always position them as close to the PC as possible. When SCSI cables get too long (SCSI cables should not be more than

10 feet), they can affect the performance of the attached devices.

SCSI-1 VS SCSI-2

The original formal SCSI Specification (SCSI-1) was published in 1986 by the ANSI SCSI Committee. It was clear after the original Specification came out that more work needed to be done on it. Since SCSI is an open standard and there are new types of devices being added all the time, the ANSI SCSI Committee began working on an update to the Specification. This update was ready in 1990. However, because of some technical matters it has not formally been released by the ANSI Committee. The formal release is expected to come this year. But, people have been using this

Specification since 1990.

The difference between SCSI-1 and SCSI-2 is primarily a difference in definition. SCSI-1 and SCSI-2 are compatible with each other and there are no major changes in the newer Specification. What is different is that there are some new modes of operation added, such as 10Mb per second Fast SCSI-2. There was also some additional work done on terminators. Active Termination was added. Active termination is a better way of terminating the SCSI chain than resistors because it improves the signal quality of the SCSI bus. The high density 50-pin connector is strictly a SCSI-2 connector. However, when it comes to device compatibility SCSI-2 is, in most cases, a superset of SCSI-1.

There were some additional functions that have been made mandatory in SCSI-2 that were not mandatory in SCSI. For example, arbitration is now something that SCSI-2 devices must be able to handle. Arbitration deals with the priority of devices that try to get on the SCSI bus at the same time.

In theory, all SCSI-1 devices should work with all SCSI-2 controllers. In practice, some SCSI-1 devices were not properly set up to handle issues like arbitration. The safest thing for you to do when you're setting up your SCSI system is to check with the manufacturer and ask if the system meets the SCSI-2 Specification. If it does, and your controllers meet the SCSI-2 Specification, there is a very good chance that all of your periph-

(continued on page 18)

Earn \$4,000 Per Month From Your Home With A Computer!



FREE CBSI 486 SX Computer

Quit spending money on your computer and let it earn money for you. This is a proven turnkey business an individual or couple can run. If you purchase our software and business program, we will give you the computer

and printer. If you already own a computer, you may receive a discount. Begin part-time and still retain the security of your present position. We will provide free home office training. Financing available.

Learn how others are building a lifetime income!

To receive your free cassettes and color literature, call toll-free:

1-800-343-8014, ext. 1120

(in Indiana: 317-758-4415) (Fax: 317-758-5827)

Or Write: Computer Business Services, Inc.
CBSI Plaza, Ste. 1120, Sheridan, Indiana 46069



DISK FULL ERRORS? LET MCM AND SEAGATE HELP!



We're proud to announce
the opening of our new
distribution facility in
Reno, Nevada!

Seagate HARD DRIVES

MCM is now a
RCA/GE premier
distributor

3.5" low profile design • Low power consumption makes these drives ideal for both home and laptop applications • High reliability

Order #	Mfg. #	Capacity	Access Time	Interface	Price
83-1840	ST351 A/X	42MB	28MS	AT/XT	Call for MCM's low price
83-1845	ST3120A	106MB	16MS	AT	
83-1850	ST3144A	130MB	16MS	AT	
83-2390	ST3290A	260MB	16MS	AT	

To order, or request a free catalog...

Call 1-800-543-4330

To order by fax... Call 1-513-434-5969



MCM ELECTRONICS
650 CONGRESS PARK DR.
CENTERVILLE, OH 45459-4072
A PREMIER Company

PCU-02

If you want to make Windows run more than just all right, here's how.

by Paul Ferrill

Many PCs sold today have Microsoft Windows 3.1 preloaded on the hard disk. That means you get a stock version of Windows without any fine tuning that could speed up your operation. A number of different areas affect the overall performance of each particular computer. We'll attempt to give you some suggestions for getting the most out of your system without spending a lot of money.

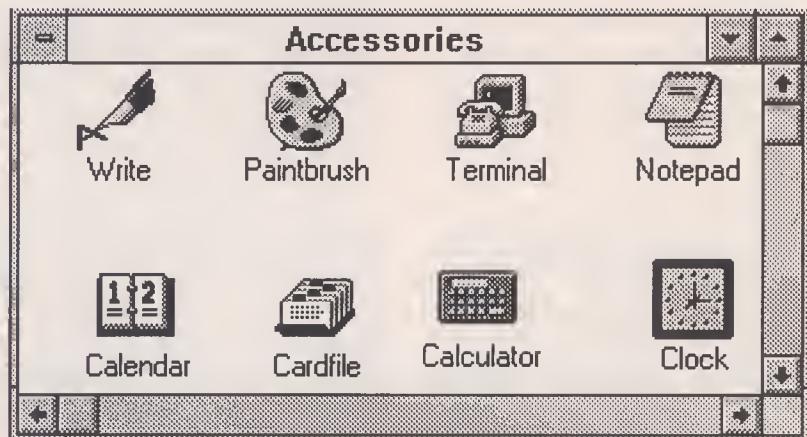
Check Your Configuration

A multitude of things affect Windows performance on your computer. A good place to start looking for ways to improve is in your AUTOEXEC.BAT and CONFIG.SYS files. The loading of drivers and TSR programs have a significant impact on memory usage. Adjusting these files to fit the amount and type of memory available will make a big difference in how well your system runs.

For a 386/486 system with 4MB of memory running DOS 5.0 or higher you might try a CONFIG.SYS file like the following:

```
DEVICE=C:\HIMEM.SYS
DOS=HIGH,UMB
DEVICE=C:\EMM386.EXE
NOEMS
FILES=30
BUFFERS=30
```

These commands first load the HIMEM.SYS driver for managing



extended memory. Extended memory is all memory above 1MB in your PC. So, by definition, if you have a machine with 8MB of memory your machine has 7MB of extended memory. The next command instructs the operating system to load all internal tables for DOS 5 into the High Memory Area (HMA). The HMA uses the first 64K of extended memory. The next command loads EMM386.EXE to manage the Upper Memory Block (UMB) area. UMB memory exists between the DOS upper limit of 640K and the start of extended memory. The remaining two commands define the number of open files at one time and the number of DOS buffers to allocate.

The absolute minimum amount of memory needed to run Windows is 2MB. However, the more memory you have the better off you'll be. Most standard 386 and 486 machines can handle 8MB of memory on the motherboard using 1MB SIMMs. At a cost of between \$35 and \$50 per

megabyte, you'll see a dramatic gain in performance for a relatively small investment.

Several commercial products offer improvements over the standard Microsoft memory management products. QEMM 7.0 from Quarterdeck Office Systems and Memory Commander from V Communications, both \$99.95, offer a whole array of features for enhancing your memory. The Manifest program included with QEMM will help you configure QEMM so that it fits your computer best.

V Communications' Memory Manager loads your network drivers, TSRs and device drivers high and optimizes high RAM, just like the other memory managers and then goes one step further. It takes high RAM and adds it to low DOS. So, if you have 100Kb of high RAM left over after optimizing, Memory Commander can increase your conventional memory ceiling from 640Kb to 740Kb.

NetRoom 3 (\$99.00 from Helix

Software) provides a similar set of functionality as QEMM with a few added features. You get the memory management program along with a screen saver, disk cache, RAM drive, screen accelerator for DOS, and virus protection in one package. All of the products fully support DOS 6.0 and add additional functionality to the standard Microsoft offering.

The Swap File

Another factor in Windows performance deals with the swap file. Windows uses either a temporary or permanent swap file to copy (or swap) memory to disk during multitasking. Permanent swap files require contiguous disk space so that Windows can use direct disk reads and writes. Temporary swap files use any available disk space but are much slower since Windows can't use the lower level direct access methods.

The control panel governs the creating and managing of swap files. Clicking on the 386 Enhanced icon from the control panel brings up a dialog box that includes a Virtual Memory button. Clicking on this button brings up another dialog box detailing the current virtual memory settings. You'll find the current size and location of the swap file along with a selection window allowing you to change either parameter. Swap files need contiguous disk space so you won't be able to create a very large one if your disk is badly fragmented. (See the article on How to Get the Most from your Disk Drive elsewhere in this issue.)

Add Some Cache

Overall disk performance can be enhanced by using a disk caching program. The SMARTDRV.SYS program provided with Windows 3.1 offers disk caching at the expense of

system memory. If you're short on memory already you'll probably not want to give any up for a disk caching program. On the other hand, if you've got memory to burn, it's definitely an option worth considering. To create a cache you'll need to add the following line to your CONFIG.SYS file after the HIMEM.SYS and EMM386.EXE lines:

```
DEVICEHIGH=C:\DOS\  
SMARTDRV.SYS 1024 512
```

This will create a 1MB cache, load the driver in high memory, and prevent other programs from reducing the cache to less than 512KB.

Check Your Windows INI Files

Windows uses several files to initialize various parameters each time you start it up. You might want to change these files to read-only to prevent accidental deletion. Assuming your system has Windows loaded in the C:\WINDOWS directory you can do that by typing:

```
ATTRIB +R C:\WINDOWS\*.INI
```

The WIN.INI file contains all of the initialization parameters that Windows needs to get started. The best way to look at and modify WIN.INI is with the SYSEDIT program. SYSEDIT makes a backup copy of your WIN.INI file just in case you want to put it back like it was before you started messing with it. Another good idea is to create a separate directory to keep backup copies of all your important files. Do that by typing:

```
CD \ MD WINSAVE COPY  
  \WINDOWS\*.INI \WINSAVE  
  COPY \WINDOWS\*.GRP  
  \WINSAVE
```

With the advent of TrueType fonts Microsoft brought the ability to see

text on the screen exactly as it will appear on paper. This new capability also brought with it the potential for abuse. The [fonts] section in WIN.INI lists all the fonts that Windows will load at startup.

If you've loaded a few application programs that use fonts heavily, such as a word processor or desktop publisher, you can expect to find a large number of fonts to be loaded. The trick is to delete the fonts that you don't need while keeping those used by the application programs. Consult the manual for each program to determine the minimum requirements for font files.

If you're not interested in performing surgery on your .INI files you might want to take a look at WinSense (\$49.95 from SoftLogic Solutions). This program uses a knowledge base to help you optimize your configuration. Using a series of question and answer sessions WINsense determines the way you use your system and then modifies the .INI files for the best fit.

Add a RAM Disk

Many Windows application programs use temporary files during their application. You can speed up access to these files by creating a RAM disk. RAM disks use available extended memory to emulate a hard disk and therefore should probably be avoided unless you have a machine with at least 8MB of memory. Creating a 2MB RAM disk requires a line to be added to the CONFIG.SYS file as follows:

```
DEVICE=C:\WINDOWS\  
RAMDRIVE.SYS 2048/E
```

You'll want to add a line to AUTOEXEC.BAT to create an environment

(continued on page 18)

Use DEBUG to Convert a Disk Directory Listing into a List of Files

by Jules Gilder

When automating operations such as copying files or sending files to the printer, I've often found it convenient to make a list of the appropriate files and then convert that list into a batch file that will do what I want.

There are several ways you can do this. You can type in the names of each file individually, but that's time-consuming and wasteful. Alternatively, you can issue the DIR command and redirect the screen output to a file with the DIR > FILENAME command. Instead of showing you the directory listing on the screen, it's sent to the file called FILENAME. This file is a straight text or ASCII file and can be read by any word processor or text editor.

To create a list of files from such a directory listing, you need to eliminate a lot of extraneous information, such as file size, date and time of creation. If your word processor or text editor has a macro programming capability, it shouldn't be too difficult to automate the removal of this excess information.

As an alternative, you can use this short DEBUG utility program to do the same thing. I call this program STRIPDIR, because we're stripping the directory listing of unwanted information. You can recreate this pro-

gram on your own computer by using a text editor to type in the program listing and create an ASCII (text) file. If you use a word processor, turn off all formatting capabilities and save the file as a DOS text file.

Although the listing (*which appears on page 18*) is very well-commented, do not type these comments in because they will cause errors and prevent you from generating the STRIPDIR.COM file.

The program starts off by specifying the name to be used to generate the COM file and also specifying what location in memory the program is going to run at—in this case 100 hex. The first actual program instruction zeroes out the BL register which we're going to use as a character counter. If you look at a directory listing, you'll see that it has a lot of information following the file name. We want to discard that information, so we want to know when we've come to the end of the name and everything else can be thrown away. Maximum length of a file name is eight characters plus a separator between the name and the file extension type. The extension is three characters long, so all together, we're going to want to know when we've read in the first twelve characters of a line.

Hence the need for a character counter.

The first instruction which zeroes out the BL register uses a mathematical trick. Any number that is *Exclusively-ORed* with itself, becomes zero. After we initialize the character counter, we use DOS's Interrupt 21 to read in the first character of the first line. Once read, the character is temporarily stored in the AL register.

The next group of instructions use a variety of compare commands to see if the first character on the line is a space, a percent sign, period, a carriage return or a linefeed. All of the lines we want to throw away begin with one of these characters. In addition, we check to see if the character is an end of file marker, in which case we terminate our program and return to DOS.

For this program to work properly, it is essential that your file has an end of file marker in it. You don't normally get it when you redirect a DIR listing to a file. To make sure it's there, type in the following (this assumes the file containing your directory listing is called NAME1):

```
copy NAME1+EOF NAME2
```

(continued on page 95)

NRI knows: The best way to learn to service today's computers is to actually build a state-of-the-art computer from the keyboard up.



TRAIN WITH THE LEADER - NRI

Train with NRI and prepare for a high-paying position as a computer service technician, even a computer service business of your own! Regardless of your previous electronics background, you can succeed with NRI, the leader in career-building at-home electronics training for over 78 years. You begin with the basics, rapidly building on the fundamentals of electronics to master today's advanced microcomputer concepts.

LEARN BY DOING

NRI's highly acclaimed learn-by-doing

own pace — no classroom pressures, no night school, no need to quit your present job until you're ready to make your move! Step by step you're guided through the assembly of a powerful 486sx-based computer system — the centerpiece of your coursework — complete with monitor, floppy drive, 80 meg hard drive, operating and applications software.

You get the hands-on experience you need to troubleshoot any IBM-compatible computer, plus the confidence to tackle any service job you take on. What's more, you work with today's most popular integrated software package, Microsoft Works, learning to use its word processing, spreadsheet, database, and communications utilities for your own

RUSH POSTAGE-PAID CARD FOR YOUR FREE CATALOG!



Every NRI course features practical, hands-on training with state-of-the-art equipment you keep.

Only NRI gives you the training and the equipment for career advancement, part-time earnings, or even a business of your own.

CHECK ONE Please send my free catalog on NRI training in:

- Microcomputer Servicing
- Computer Programming
- TV/Video/Audio Servicing
- Security Electronics
- Basic Electronics
- PC Applications Specialist
- Programming in C++ with Windows
- Bookkeeping and Accounting
- Paralegal
- Fiction/Nonfiction Writing
- Writing Children's Literature
- Building Construction & Remodeling
- Interior Design
- Air Conditioning, Heating, Refrigeration
- Electronic Music Technology
- Locksmithing
- Home Inspection
- Small Engine
- Automotive Servicing
- Computer-Aided Drafting

Name	(Please Print)	Age
Street (No P.O. Box numbers please)		
City	State	Zip

Accredited Member, National Home Study Council

MASTER YOUR FUTURE

The Department of Labor forecasts over 220,000 jobs for computer service technicians by the year 2005 — a full 38% increase over today's level. With the right training and skills, you can cash in on this wide-open opportunity and become a high-paid computer service technician. Whether you choose a full- or part-time job — or start a computer service business of your own — you'll be well prepared, continuously drawing on the real-world experience of your NRI training. Master electronics and computers the NRI way and master your future!

LEARN ABOUT NRI TODAY

NRI's free, full-color catalog covers every aspect of NRI's innovative training, as well as hands-on training in other growing high-tech fields. If this coupon is missing, write to: McGraw-Hill Continuing Education Center, 4401 Connecticut Avenue, Washington, DC 20008.

CATALOG

on, DC 20008
Programming in C++ with Windows
ublishing & Design
ssing Home Business
ng & Accounting
action
Instruction
e Repair
e Servicing



For career courses approved under GI Bill, check for details.

3390-1093

Age _____
Study Council _____ 3390-1093

Use DEBUG to Convert a Disk Directory Listing into a List of Files

by Jules Gilder

When automating operations such as copying files or sending files to the printer, I've often found it convenient to make a list of the appropriate files and then convert that list into a batch file that will do what I want.

There are several ways you can do this. You can type in the names of each file individually, but that's time-consuming and wasteful. Alternatively, you can issue the DIR command and redirect the screen output to a file with the DIR > FILENAME command. Instead of showing you the directory listing on the screen, it's sent to the file called FILENAME. This file is a straight text file and can be read by a word processor or text editor.

To create a list of files from a directory listing, you need to eliminate a lot of extraneous information such as file size, date of creation. If your word processor or text editor has a macro capability, it shouldn't be difficult to automate the removal of excess information.

As an alternative, you can use the DEBUG utility program to do the same thing. I call this program STRIPDIR, because we're stripping the directory listing of unnecessary information. You can recreate

the program on your own computer by using a text editor to type in the program listing and create an ASCII (text) file. If you use a word processor, turn off all formatting capabilities and save the file as a DOS text file.

Although the listing (which appears on page 18) is very well-commented, do not type these comments in because they will cause errors and prevent you from generating the STRIPDIR.COM file.

The program starts off by specifying the name to be used to generate the COM file and also specifying what location in memory the program

Hence the need for a character counter.

The first instruction which zeroes out the BL register uses a mathematical trick. Any number that is *Exclusively-ORed* with itself, becomes zero. After we initialize the character counter, we use DOS's Interrupt 21 to read in the first character of the first line. Once read, the character is temporarily stored in the AL register.

The next group of instructions use a variety of compare commands to see if the first character on the line is a space, a percent sign, period, a carriage return or a linefeed. All of the lines we want to throw away



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT NO. 10008 WASHINGTON, D.C.

POSTAGE WILL BE PAID BY ADDRESSEE

NRI Schools

McGraw-Hill Continuing Education Center
4401 Connecticut Avenue, NW
Washington, DC 20078-3543

NRI knows: The best way to learn to service today's computers is to actually build a state-of-the-art computer from the keyboard up.



TRAIN WITH THE LEADER - NRI

Train with NRI and prepare for a high-paying position as a computer service technician, even a computer service business of your own! Regardless of your previous electronics background, you can succeed with NRI, the leader in career-building at-home electronics training for over 78 years. You begin with the basics, rapidly building on the fundamentals of electronics to master today's advanced microcomputer concepts.

LEARN BY DOING

NRI's highly acclaimed learn-by-doing approach gives you a complete understanding of the intricate electronics behind the 1 meg RAM, 32-bit CPU computer system included in your course. You perform hands-on electronics experiments with your NRI Discovery Lab and digital multimeter, then build and test the powerful 486sx/25 MHz computer you train with and keep. You install the 1.2 meg, 5-1/4" floppy disk drive, learning disk drive operation and adjustment. Later, you dramatically improve your computer's data storage capacity by installing a powerful 80 meg IDE hard drive. You even learn to diagnose and service virtually any computer problem with the extraordinary R.A.C.E.R. plug-in diagnostic card and QuickTech diagnostic software also included in your course.

STUDY AT YOUR OWN PACE

With NRI, you study in the privacy and convenience of your own home — with your personal instructor and NRI's team of technical professionals behind you every step of the way. You learn at your

own pace — no classroom pressures, no night school, no need to quit your present job until you're ready to make your move! Step by step you're guided through the assembly of a powerful 486sx-based computer system — the centerpiece of your coursework — complete with monitor, floppy drive, 80 meg hard drive, operating and applications software.

You get the hands-on experience you need to troubleshoot any IBM-compatible computer, plus the confidence to tackle any service job you take on. What's more, you work with today's most popular integrated software package, Microsoft Works, learning to use its word processing, spreadsheet, database, and communications utilities for your own personal and professional applications.

It's a fact: Only NRI gives you such thorough, effective training in computer servicing. And no other school gives you hand-on experience with a computer more powerful than the 486sx-based system included in your course.

IBM is a registered trademark of International Business Machines Corp. R.A.C.E.R. and QuickTech are registered trademarks of Ultra-X, Inc.

MASTER YOUR FUTURE

The Department of Labor forecasts over 220,000 jobs for computer service technicians by the year 2005 — a full 38% increase over today's level. With the right training and skills, you can cash in on this wide-open opportunity and become a high-paid computer service technician. Whether you choose a full- or part-time job — or start a computer service business of your own — you'll be well prepared, continuously drawing on the real-world experience of your NRI training. Master electronics and computers the NRI way and master your future!

LEARN MORE ABOUT NRI TODAY

Send today for NRI's free, full-color catalog that describes every aspect of NRI's innovative computer training, as well as hands-on training in other growing high-tech career fields. If coupon is missing write to: NRI Schools, McGraw-Hill Continuing Education Center, 4401 Connecticut Avenue, NW, Washington, DC 20008.

SEND CARD TODAY FOR FREE NRI CATALOG

NRI Schools

McGraw-Hill Continuing Education Center
4401 Connecticut Avenue, NW, Washington, DC 20008

McGraw-Hill

Check one FREE catalog only

- MICROCOMPUTER SERVICING
- TV/Video/Audio Servicing
- Telecommunications
- Industrial Electronics & Robotics
- Security Electronics
- Electronic Music Technology
- Basic Electronics

- Computer Programming
- Programming in C++ with Windows
- Desktop Publishing & Design
- Word Processing Home Business
- Bookkeeping & Accounting
- Home Inspection
- Building Construction
- Small Engine Repair
- Automotive Servicing

For career courses
approved under GI Bill,
check for details.

Name (please print)

Age

Address

City/State/Zip

Accredited Member, National Home Study Council

3390-1093

Stripdir

To create a file listing from selected files in your disk directory, simply type the following commands into any text editor and save them as an ASCII (text) file. If you use a word processor, save it as a DOS text file.

TYPE	WHAT IT DOES	TYPE	WHAT IT DOES
N STRIPDIR.COM	name of file	CMP BL,0C	do we have 12 characters yet?
A 100	start at location 100 hex	JNZ 0120	no, get next character
XOR BL,BL	put a zero in register BL	MOV DL,0D	yes, print a carriage return
MOV AH,07	read 1st character of line	INT 21	
INT 21		MOV DL,0A	then print a linefeed
CMP AL,20	is it a space?	MOV AH,06	
JZ 013F	yes, skip line	INT 21	
CMP AL,25	no, is it %?	JMP 0100	go back for a new line
JZ 013F	yes, skip line	MOV AH,07	skip line routine
CMP AL,2E	no, is it a period?	INT 21	read next character
JZ 013F	yes, skip line	CMP AL,0A	is it a linefeed?
CMP AL,0D	no, is it a carriage return?	JZ 0100	yes, get the next line
JZ 0100	yes, get 1st character of next line	CMP AL,1A	no, is it the end of the file?
CMP AL,0A	no, is it a linefeed?	JNZ 013F	no, skip a line
JZ 0100	yes, get 1st character of next line	INT 20	yes, return to DOS
CMP AL,1A	no, is it the end of the file?		
JNZ 0124	no, go print it	rcx	get ready to change value
INT 20	yes, return to DOS	4D	in CX register
MOV AH,07	start of print line routine	w	change it to 4D, length
INT 21	get next character in line	q	of this program
MOV DL,AL	put it in DL to print it		save program to disk
MOV AH,06	print it		quit Debug, return to DOS
INT 21			
INC BL	increment character counter		

Putting Windows to Work

(continued from page 15)

variable to point to the new drive:

MDE:\TEMP SETTEMP=E:\TEMP

These lines create a directory on drive E named TEMP, assuming that your RAM disk is named E. It's important to remember that this disk will cease to exist when you turn the power to the computer off. In other words, don't put anything that you don't want to lose on this drive.

Wrapping It All Up

No simple answer will fit every computer that runs Windows. However, by following a few simple guidelines and taking a peek under the hood you can expect better than average performance from your machine. ■

Products Mentioned

Net Room 3

Helix Software
47-09 30th St.
Long Island City, NY 11101
(718) 392-3100

Price: \$99.00

QEMM 7.0

Quarterdeck Office Systems
150 Pico Blvd.
Santa Monica, CA 90405
(310) 392-9851

Price: \$99.95

Memory Commander

V Communications
4320 Stevens Creek Blvd.
San Jose, CA 95129
Telephone Order: (800) 648-8266

Price: \$99.95

Special Offer Pricing!: Send or fax copy of cover or call in serial number of any other memory manager, including DOS 5.0 or 6.0, and Memory Commander is \$49.95.

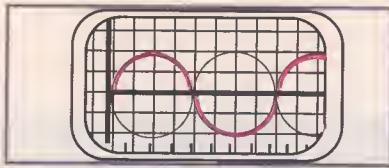
Fuzzy About SCSI?

(continued from page 13)

erals will work well together.

Occasionally, you'll come across SCSI-1 devices at extremely good prices and there's a good chance that the SCSI-1 device will work with a SCSI-2 controller. But, if you buy such a device, make sure you have return privileges. It may not be compatible with your system.

Generally, if you are just connecting one or two devices to your PC, SCSI-1 devices should be sufficient. But, if you plan to hook up multiple different devices, your chances of them working all together are much better if they're SCSI-2. This is because the Specification was tightened up, the commands were defined better, and the way devices work together on a bus was defined in a much clearer manner. ■



THE

TEST CENTER

This month we look at seven major programs from the three leading software suppliers of diagnostic tools: Diagsoft, Landmark Research, Touchstone Research.

An Aid To Diagnostic Aides

by Joseph F. Peschel

Some people yearn for a beach house on the California coast, others are eager to show-off their shiny metallic two- and three-wheelers in Sturgis, while still others enjoy the thrill of discovering more about the internal workings of their computer. Most of us, at one time or another, for one reason or another, fall into the last group — myself included.

Fortunately, there are plenty of (shall we call it discovery software?) utilities that will help you diagnose and understand your system. We'll be taking a look at a myriad of products from DiagSoft, Landmark, and Touchstone Software. Touchstone will even send you a phillips/flathead screwdriver so you can dispense with your Swiss Army knife, if you like.

A decent diagnostic utility ought to provide thorough system information about used and available IRQ

and DMA channels. It should furnish a text editor that will let the user easily view and modify Autoexec.bat and Config.sys, and incorporate a battery of performance tests, along with providing a torrent of exhaustive diagnostic tests.

Most of the following programs do that and much more. You'll find, naturally, that some programs perform at least one function better than other programs. Your first impulse will probably be to get your hands on most of this software, operating on the uneconomical theory that you can never have too many tools. I favor the pricey, about \$350, QAPlus/Fe. For a hundred bucks less, CheckIt Pro Deluxe is not a bad investment. Both programs offer superb diagnostic testing, with the /Fe version of QAPlus going to greater testing depth than any of the other programs.

You'll find some programs are capable of performing a low-level format. You will also note that other than this paragraph I won't say much about that, preferring to use the format routine that came with the drive, or the ROM-based routine from the controller. If you have an IDE drive, use the low-level routine from the drive manufacturer and no other. As for marking bad blocks on a hard drive—that action is best left to the Symantecs and PC Tools of the world, unreviewed here.

All of these programs were tested, initially, on a somewhat barebones 486/33 with a 200Mb hard drive, mouse and modem. A sound card, CD-ROM, and laser printer were added to the system later.

I'll also offer a few tips on running diagnostic software and give some advice about what to do if a test fails.

Diagsoft's QAPlus/Fe Ver. 5.12

Intended for the field engineer or power user, QAPlus/Fe is a very impressive DOS-based utility. The multilevel menu is easy to get a feel for, with help readily available via F1, but moving from performance to di-

agnostic testing makes you impatient.

If you are looking for a program that provides in-depth diagnostics, serial and parallel loopbacks, and comprehensive performance testing,

you'll find them in this package. You can opt to run the quick test or select different test modules. Each module will perform a battery of tests, selected on-the-fly or saved as scripts, on such ordinary components as the

motherboard, com ports, and hard drives. But QAPlus/Fe will also allow you to run tests on several SCSI devices and non-SCSI CD-ROM drives. Like the rest of the software reviewed here, you can create a report of diagnostic failures, or log all results to a file or to a device at Lpt1 or Com1. QAPlus/Fe also includes a database utility to log the hardware configuration and diagnostic reports.

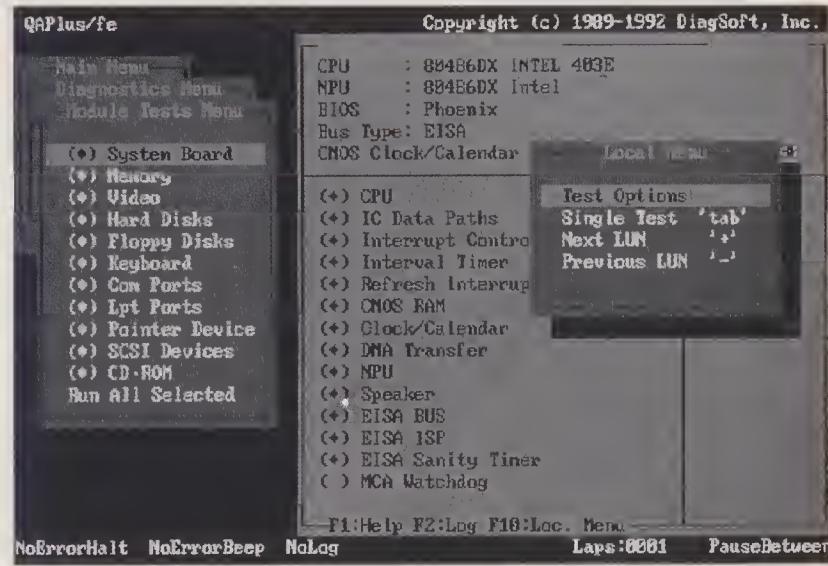
Complementing the suite of built-in tests is "User Diags," which lets you run up to 15 .Exe or .Com programs of your choice as tests.

Performance tests are executed by Power Meter, which also generates some system information. None of the other software under review here can match this program's tests. Among its many test suites, Power Meter will measure the performance of the CPU, hard and floppy drives, video card, and the system's overall computing ability. It also measures capability in PMUs (Power Meter Units) and allows for system comparisons and database searching and merging.

Available as part of the QAPlus/Fe program, or separately for about \$100, Power Meter is the dream of anyone who is seriously into testing and comparing the computing pinnacles of dueling PCs. While the Power Meter rating does not stand alone as a benchmark, for comparison with other systems we found it ideal.

Along with utilities that let you edit configuration files, Windows .ini, and most any other file, QAPlus/Fe offers a method to locate bad memory chips, SIMMs, SIPs, or DIPs. To use the RAM locator, however, you'll need to know the memory layout and the location of the parity chip.

System information, too, is readily available and can be saved to a file or printed. During testing, this software had no problems identifying two ports using the same IRQ. When the IRQ of



the modem was changed to use the Cascade interrupt, it correctly identified IRQ 9 as the used IRQ, as did most of the other software tested. Information about TSRs and device drivers was quite accurate, but I prefer the information offered by TouchStone's SysInfo.

Not only did the program provide accurate information about the physical characteristics of the hard drive, it accurately identified a DoubleSpace hard drive. In addition, DiagSoft says their products will identify Pentium processors, detect the IRQ of a host of sound cards, and recognize the presence of QEMM high RAM.

DiagSoft products also had the edge in CD-ROM tests: No other manufacturer reviewed here offered such convincing diagnostic tests. (But even DiagSoft's own Power Meter doesn't allow CD-ROM performance testing.) The /Fe tests, a butterfly read, a transfer rate test, and an eject test, among seven tests, performed without a glitch.

Nothing is ever perfect, however. Though QAPlus/Fe identified the correct address (530H) of the Windows Sound System card, it could not identify the IRQ (10) or the DMA

channel (0) being used. We trust that in the next version of the program that card will be added to the growing list of sound cards that can be identified during the IRQ/DMA report.

Although there is a menu choice that allows you to align floppy disk drives, the utility itself is not included in this package. QAFloppy, the program for drive alignment, can be purchased separately for around \$150 if you already use this version of QAPlus/Fe, or \$300 if you don't.

QAPlus/Fe and the other DiagSoft products go file editing one better with the inclusion of QAMatch. This program will allow you to compare original and revised configuration files to help you discover where the revision went wrong, for instance, when things go wrong after a new driver is installed.

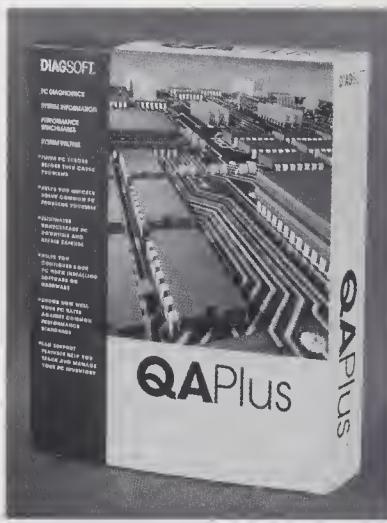
Like the rest of the DiagSoft line, QAPlus/Fe is bundled with the host portion of "Reach Out," so that DiagSoft can provide remote electronic support. Though no anti-viral software is offered with QAPlus/Fe, this program, as well as QAPlus (DOS) employs an intruder alert to warn you if a virus is attempting to alter its files.

DiagSoft QAPLus Ver. 4.72 (DOS)

At a cost of about \$160, QAPLus does not provide the extensive testing capabilities of its /Fe brother. It does provide more than thorough diagnostic testing, but is limited in that the tests can be repeated only 10 times, while the /Fe version can run them continuously. Many of the features and tests incorporated in QAPLus/Fe appear in QAPLus in abbreviated form.

Performance testing is limited to CPU, video, and mathematical coprocessor speed; hard drive performance is measured by data transfer rate, average seek time, and DOS file transfer speed. Similar to /Fe, QAPLus lets you add your own test, renamed Diags6.exe/.com.

The determination of hardware configuration and IRQ/DMA usage has improved considerably when viewed against previous versions of this program. In fact, in testing,



QAPLus impressed us in determining the existence of a DoubleSpace drive and the sharing of two IRQs as reliably as QAPLus/Fe.

This more modest DiagSoft offering also detected a Windows Sound

System at the correct address. Like /Fe, though, the program was unable to determine which IRQ and DMA channel was used. DiagSoft says that the IRQ/DMA channels of most Sound Blaster and Sound Blaster compatible cards, as well as other sound cards, will be detected and identified.

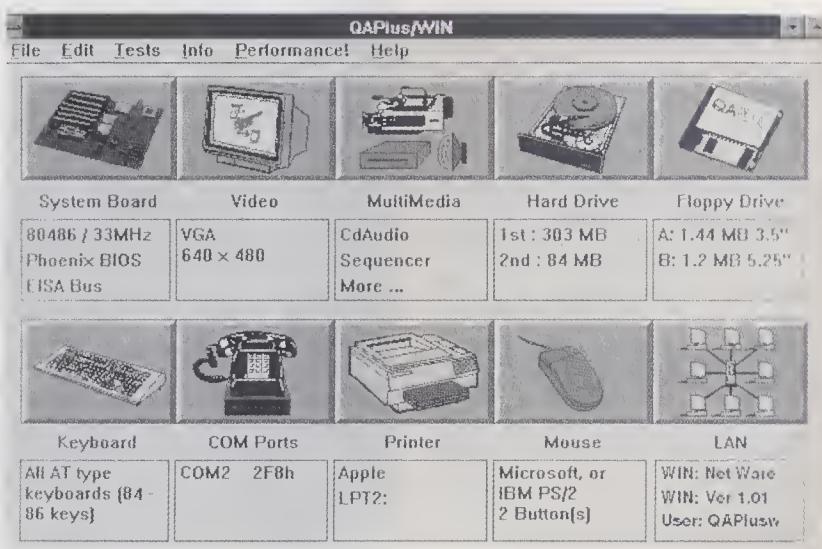
You'll find a handy CMOS editor, and a text editor useful for editing any file. You'll also find a memory map of the first Meg and a DOS memory map, in addition to device driver and environment information. The information given about device drivers including Dblspace.sys proved reliable. TSR information was also accurate. No software interrupt info here, though, unfortunately.

If you're interested in QAPLus/Fe, but can't afford the hefty price you might want to look seriously at QAPLus or QAPLus for Windows.

DiagSoft's QAPLus/Win Ver. 5.12

Bundled with a special QAPLus DOS version and sold for about the same price, QAPLus/Win offers the reporting of software interrupts that QAPLus(DOS) ignores. You'll also find software IRQ reporting in TouchStone's SysInfo and Landmark's Win:Probe. You can sort, browse and edit QAPLus/Win's numerous reports that are kept in the database.

Rely on the included DOS program for information about TSRs. Although QAPLus/Win identified the correct addresses where Dblspace.sys and Setver.exe were loaded high, it could not identify TSRs, such as a mouse driver and Novitsr (the ac-



companying anti-viral utility), that were loaded high.

The QAPlus interface in Windows, too, seems inadequately used. You'll find no report about the hardware IRQ or DMA usage. Instead, DiagSoft suggests a report from a DOS environment is more reliable than one under Windows. You edit configuration files and run QAMatch through the "Windows Resource Control Center." What makes the control center interesting is that it will highlight sections of Win and System.ini at the

touch of a button for quick editing.

This program will test almost every component that the DOS version tests. But memory tests cannot be very thorough while running under the Windows environment; you'll want to run memory tests from the DOS program.

Rely on the included DOS program for most performance tests. The only performance tests in QAPlus/Win are limited to the hard drive, though the user can define a handful of testing patterns.

Novi Scan virus detection software is included in this version of QAPlus/Win, along with the host version of remote software.

If the Windows portion of the program tickles your fancy, you may want to wait until November to buy the stand-alone version of QAPlus/Win. DiagSoft will continue to send a DOS-based version of QAPlus as well as the remote software with the new QAPlus/Win. It was, however, undetermined at press time if anti-viral software would be included.

TouchStone's CheckIt Pro Deluxe Release 1.06.

TouchStone Software bundles its SysInfo, Advanced Tests & Tools and Deluxe Tool Kit and markets the suite of programs as CheckIt Pro Deluxe. A close runner-up to DiagSoft's QAPlus/Fe, CheckIt wins the ease of use war by nose: it's mouse driven, unlike QAPlus/Fe and, although it's a DOS program, makes significant use of buttons, icons, and dialogue boxes in its menu.

The deluxe package, selling for about \$250, includes serial and parallel loopbacks, a screwdriver, labels for mice, fax cards, and SCSI devices as well as the hex address labels for the ports.

While DiagSoft offers QAFloppy as a separate package, TouchStone offers, as part of its Deluxe program, two "Mini-spiral" disks to perform floppy drive alignment and solve drive rotation problems. The Deluxe Tool kit can be purchased separately for around \$100. Likewise, SysInfo can be bought separately or bundled with Advanced Tests And Tools as CheckIt Pro.

A review of Touchstone's other diagnostic programs follows.



Hints & Tips: Diagnostic Utilities

It's always a good idea to find out as much information and perform as many tests as you can before you have a problem. Most of us, however, wait until we add a card or a device driver or both and discover that things don't work as they used to. Some of you probably build your own computers — for you it's even more important to run tests as soon as you can access a drive. You'll want to forget being economical and buy as many utilities as you can get your hands on, perhaps some of the utils reviewed here. For you QAPlus/Fe is a must.

But no matter which program you purchase, make a mental or written list of what you want to discover. I recommend determining information about the system first.

If you want to uncover information about IRQs, device drivers, and software interrupts, you'll need to boot from the hard drive—with all

the device drivers installed.

Even though that may appear obvious, you'd be surprised how many people, even technicians, can go wrong. Often, you'll find diagnostic utils are bootable. This can lead you directly to an A: prompt rather than the hard drive and can result in a failure to detect the IRQ that the mouse, for example, is using.

There are a few exceptions to this rule. Occasionally, a memory manager that uses several qualifiers can distort true reporting of hardware IRQ, and the DOS program Share.exe can also cloud the air, especially with Win:Probe and QAPlus/Fe.

If you are using Win:Probe's tool to clean the .ini files, you may be drenched with a downpour of sharing violations. Your best course is to remark the Share.exe line in Autoexec and re-boot. (To remark a line, simply type REM before the

line in the file. It then will not execute.) Should you start the QAPlus/Fe program with Share installed, you'll be swept out to a C prompt. Use the qualifier: /nocrc to rectify the problem. Doing so will bypass /Fe's intruder alert, so make sure your drive is virus free. QAPlus(DOS) doesn't share /Fe's difficulty with Share.

Once you have determined the IRQ and DMA channels the system currently uses, add your cards one card at a time. If you are adding several cards, it's even more important that you have a written list of planned IRQ and DMA usage. To be safe, make sure there is no sharing in your list.

Install a card and check the new information before adding the next card. This process, though it appears more time consuming, can actually take less time than throwing in several cards all at once and

TouchStone's Tests And Tools Release 1.06

Tests and Tools uses what TouchStone calls applets, pre-set command scripts, to run either Quick, Certification or Burn-In tests. Reports of the tests are automatically logged.

Individual tests of major components and a few peripherals can be performed for a specified number of passes or continuously, as in the /Fe version of QAPlus, and the results can be appended to current logs. And even though this program's counterpart, SysInfo, will detect a CD-ROM drive, you won't find any test for one.

The memory test can be configured for a quick or comprehensive

diagnostic test of base, extended and expanded memory. With EMM-386.exe loaded to furnish noems, but using addresses for various page frames, the memory test caused a system reboot. When reference to the page frame was removed the test completed successfully. That seemed a bit more satisfying than the way QAPlus(DOS) handled extended memory. Its memory test simply refused to perform, citing a conflict between itself and programs that use extended memory. The /Fe version of QAPlus had no problem testing extended memory, while Win:Probe

tested most extended memory, skipping the area in use by its own test.

Tests And Tools also offers a virus detection program that will search for around 2,000 of these pesky infectors. You'll find limited info on many of the viruses in the included reference library.

Though the tests are bundled with SysInfo and marketed as CheckIt Pro, you are better off buying the CheckIt Pro Deluxe version — you'll get the loopbacks and disks to test for correct floppy drive alignment. If you're looking primarily for information, SysInfo is the choice.

Hints & Tips *(continued)*

then backtracking. This process can work for both buyers and builders.

If you've already installed all of your cards and have a problem, you'll need to remove each added card and its associated device driver and get down to basics. Now, add a card at a time, with its device driver, if appropriate, and check the system information.

Occasionally, you'll find your utility won't detect certain sound, scanner or network cards. In that case, use the diagnostic that came with the card. With some sound and fax/modem cards, two interrupts will be used. Some network cards will default to already used IRQs, for example, IRQ 3. Where there is a vendor supplied diagnostic, I make it a rule to use it first, then I find out whether third-party software can actually detect it.

Under most circumstances, hard

drive controllers will not present an IRQ problem because they usually use IRQ 14 or 15. Vendors who sell other cards generally shy away from those IRQs. There are a few controllers, Adaptec's, for example, that use IRQ 11. But you'll find many network cards and some sound cards capable of using that IRQ. Often it's possible to change the controller's IRQ to trigger 14 or 15 if the sound or network card can't be changed.

If you are interested in running performance tests, especially those like Power Meter, you'll want to boot clean and then boot from the hard drive. This will give your utility software the chance to distinguish how disk caching software and other drivers affect system performance.

Keep reports of the results. Most of the software reviewed will do that for you. You can save the perfor-

mance of one configuration as the standard to judge all others. You may want to go so far as remarking various device drivers — MS-DOS 6.0 makes that easy via F8. You might also rem TSRs in Autoexec and measure performance.

If you're doing an upgrade, it would be a neat idea to measure the performance of your system before and after. Please make sure you've checked out the system's anatomy before you take a snapshot of the "after" performance.

When you are running diagnostic tests on most components, your results will usually be more accurate if you boot clean.

Memory managers sometimes cause havoc with DMA controller tests, and system and video RAM tests. Even video utilities that reserve RAM can cause a test to fail. If you haven't booted cleanly, you

TouchStone's SysInfo Release 1.06

SysInfo provides numerous tables, graphics and charts in presenting its view of the anatomy of your system. Of all the products under review here, this menu seems the most logically arranged.

Starting with a summary in graphics or text mode, the information becomes more specific as the menu is pulled down. There, you'll find details about video, drives, memory and multimedia devices. As you scroll to the right, you get the feeling that no better order of information could be offered — a deft hand is at work here. Informational reports are easily generated to a printer or a file.

You'll find plenty of information

about device drivers that are loaded high. SysInfo reported that the DoubleSpace driver was loaded high, but failed, unlike the DiagSoft products, to identify the drive as a DoubleSpace drive.

Although DMA usage is not reported, plenty of software interrupt information, disregarded by QAPLus, is given. IRQ reporting, too, seems for the most part accurate, with one exception found during testing.

SysInfo will, reportedly, detect Sound Blaster and Ad Lib compatible cards, but failed to detect the Windows Sound System correctly. It detected an Ad Lib card using address 388H and didn't mention IRQ

usage. There was no problem, however, detecting the CD-ROM.

For a DOS-based program, SysInfo gives more information about and help with Windows than might be expected. Sure, there is a DOS text editor and a configuration editor, but there is also Windows summary, a viewer for the Enhanced section, and an .ini editor that will let you select the sections of the file you want to change.

The performance tests are the closest thing to a rival for Power Meter. The main system, hard disk, and video card can be compared to an IBM XT or some 15 other machines. You can also save the performance results from

may find the error messages false.

Some utilities like QAPlus/Fe will test extended memory, others will not. Most, however, will test expanded memory. If your system passes the RAM test when booting clean and you suspect a memory problem, or if you just want to be sure there isn't one, try configuring the extended memory as expanded. That will allow you to test RAM above the 1Mb barrier.

Should you collide with a memory problem, usually the bad bit will be identified for you. Programs like QAPlus(DOS) and /Fe allow you to construct a diagram of the physical memory and locate the bad bit.

If your program doesn't let you pinpoint which module is bad, try moving one SIMM to another location and run the test again. If the number of the bad bit has changed, you've found the bad module.

A device to test RAM outside the system can be handy. If your system uses DIPs you absolutely must have a DIP chip tester or face the prospect of replacing memory a few chips at a time. Memory chip testers can be very expensive, however.

The moral: If you are seriously interested in testing memory, make sure at least one of your programs has a bad RAM locator.

False failures can also occur when you test the hard drive. Make sure that you are booting clean, thus disabling the software cache.

Occasionally, you will find tests like the butterfly read or funnel seek tests fail. Try running sequential and random read tests before deciding that the drive is bad. Most utilities perform three or more tests on the hard drive. Make sure one or two tests confirm the failure. Don't be afraid to run any test continu-

ously if you suspect a failure.

If your drive is not an IDE, it may be necessary to calibrate it. This may solve some hard drive problems. Please make sure that you have a valid working backup before deciding to calibrate, re-tune, or low-level format your hard drive.

The best test of floppy drives is formatting and copying files back and forth, then comparing the copied files. That's why you saw very little mention of floppy diagnostics. There are times when one disk works consistently with one system, but not in another. Then you'll need a floppy alignment kit like the one offered with CheckIt Pro Deluxe, or the QA/Floppy program.

No matter which program you finally decide to buy, you'll get plenty of help that will complement your own workarounds in preventing a flood of computer problems. □

your machine as the standard for all other comparisons.

The help section offers a "Reference Library" that is useful for anyone who is upgrading their system, or just wants information quickly. Among more than 25 topics, you'll find information about IRQ conflicts, tips about installing drives and additional cards, plus advice on memory conservation, and information about viruses. Best of all, the files are editable so that you can update them with the text editor.

The library (whose function is somewhat like Win:Probe's "Installation Wizard") is also a part of Tests and Tools, and, therefore, a part of the Deluxe package.

Companies Featured

PRODUCT FEATURED	COMPANY
QAPlus/Fe QAPlus (DOS) QAPlus/Win QAFloppy (For QAPlus/Fe users)	\$349.95 \$159.95 \$159.95 \$299.95 \$149.95
Win:Probe	\$99
CheckIt Pro Deluxe CheckIt Pro SysInfo Deluxe Tool Kit	\$249.95 \$149.95 \$99.95 \$99.95
	DiagSoft 5615 Scotts Valley Drive Suite 140 Scotts Valley, CA 95066 (800) 342-4763 (408) 438-8247
	Landmark Research 703 Grand Central Street Clearwater, FL 34616 (800) 683-6696
	TouchStone Software 2130 Main St. Suite 250 Huntington Beach, CA 92648 (800) 531-0450 (714) 969-7746

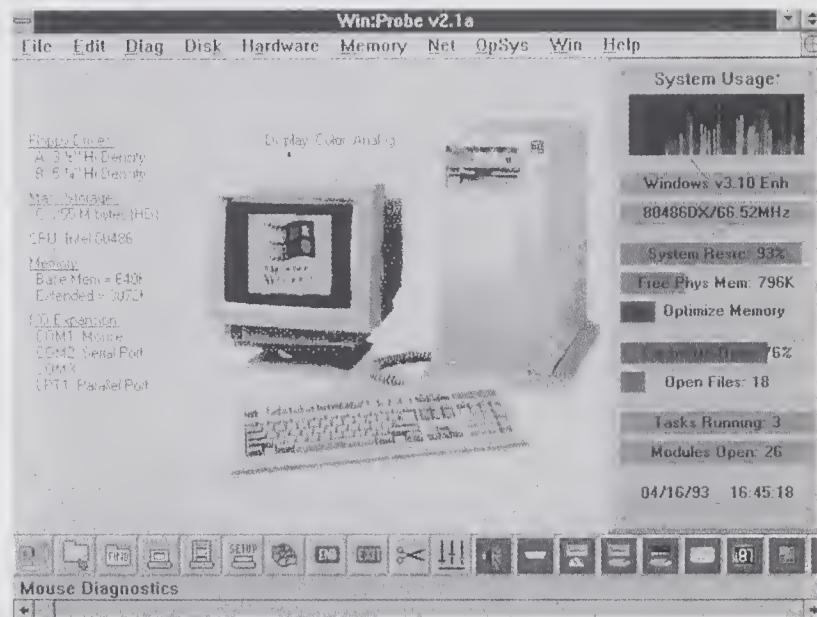
Landmark's Win:Probe Ver 2.1A

At first glance, Win:Probe, priced at \$99, looks impressive and seems to make good use of the Windows GUI with the collection of icons used for diagnostics testing, information reporting, and editing; and more icons that report, at the flick of a mouse button, RAM and hard drive utilization, Windows setup information, the number of modules in use, and Windows exception handlers. Several other potentially great features are lined-up neatly at the bottom of the screen and, because there are so many, cascade off the screen in a steady stream.

The Windows information is handy and exhaustive, but, unfortunately, at times incorrect. The amount of free system resources, for example, differed from the report given by Windows itself. Also, "Group File Tune-Up," a neat utility with lots of possibilities, reported incorrectly that C:\QaWin\QaPlusw did not exist.

DOS information is plentiful and mostly accurate. Device drivers, including the driver for DoubleSpace, were detected. But the information given about Smartdrive erred. Smartdrive 4.1 and 4.2 were identified as 4.16 and 4.36 respectively. And no matter which cache version was installed, Win:Probe didn't detect that drive C was cached via the host drive.

Win:Probe, however, will give information, through the "Installation Wizard," that's handy in determining which IRQs and DMAs are normally used by various devices—a useful reference if you plan on doing a hardware upgrade. It will point out which UMBs are normally available. Don't count on the program to tell you what IRQ and DMA channels or UMBs are being used by your system. This feature is more like TouchStone's reference library.



Drive, video and motherboard tests were present and easily accessible. The memory tests are disappointing, sketchy compared to some DiagSoft and the TouchStone products, but they end quickly if you're more concerned about time than memory. Win:Probe, though, will test extended memory, even configurations that use a page frame where QAPLus and CheckIt fail.

Most other component tests were reliable, but not of the caliber of QAPLus/Fe. And though Win:Probe will detect a CD-ROM, a program to test it is conspicuously absent. Win:Probe will also recognize the presence of certain sound cards, but in testing didn't find the correct address of the Windows Sound System. Win:Probe reported the IRQ of the mouse as Com 1, but gave no report on the IRQ assignments of the other ports, nor did it detect that our modem was using the Cascade interrupt.

Included with Win:Probe is "Landmark DOS for Windows," as an al-

ternative to shelling-out to MS-DOS, and "PC Certify," a DOS-based program.

PC Certify, version 5.1, will allow file editing and can perform some brief testing of your system's main components. When the memory test was run with Emm386.exe installed to provide 1024K of expanded memory, the test passed. When the memory manager was configured to provide noems using a page frame, Certify interpreted the memory as expanded and locked the system.

There are several reliable and quite useful features in Win:Probe that aren't found anywhere else. But there are also too many shortcomings. If you are a fan of Landmark products, or if you relish subscribing to the "PC Troubleshooter," stick with PC:Probe, reviewed in Vol.2, No.2 of this magazine.

Win:Probe is a potentially stellar product. We anticipate a look at a cleaner, more refined release in the future. ■

Mr. Drucker Builds His Dream Machine



Wherein Contributing editor, Dead Head and long-time HOG member David Drucker finds it instructive to build a 66-MHz 486-based system. We hope you will, too.

I don't want to get into touchy subjects like motivation. The hidden demons that cause a (mostly) sane individual to embark on a peril-fraught journey are — Oprah and Geraldo notwithstanding — best left in the shadows. Suffice it to say that, over a six-week period, components sufficient to build a pretty zippy computer arrived at my door. What could I do, then, but try to build it and, having done so, configure it to work properly. Rather than keep you in suspense, I'll state at the outset that, bloodied but unbowed, I completed the task. (Indeed, these words are being written on the computer in question.) Having deprived you of a surprise ending, I'll now add that it was quite an experience, and that I learned perhaps a bit more than I wanted to know about the subject. If you've got the stamina to slog through the rest of this article, it's possible that one or two of my experiences

might prove useful in the event you ever need to do more to a computer than whack it a couple of times if it doesn't light up right away.

Parts Is Parts... Not!

Yugo and Mercedes-Benz both equip their cars with tires, an engine, and bucket seats. Given the option, most of us would rather drive the Mercedes. Along the same lines, I've spent enough time elbows-deep in the bowels of computers to know that a similar situation prevails: vast differences can exist between systems having identical specifications. The issue isn't necessarily one of build quality, either: some manufacturers' components are simply better than others. That being the case, I was gratified by the overall excellence of virtually all the parts that were to make up my "dream" system.

I was especially pleased with the

choice of a Micronics MX30 VL-BUS motherboard: having recently reviewed a very impressive MicroTech system built around a similar board, I was sure that it would prove to be both fast and glitch-free. The board's ZIF socket was fitted with a heat sink-equipped Intel 80486DX2-66 processor, and its SRAM cache sockets were fully populated to their 256Kb limit. Two of its eight 16-bit ISA expansion slots were associated with VESA local bus slots. The only down side to the board was that its four SIMM sockets were conspicuously empty: I would have to scrounge a few Mb of RAM somewhere.

Equally thrilling was the hard drive: a 1.2Gb — twelve hundred megabytes! — Quantum PD1225. And, as if the fact of a 1.2Gb drive wasn't miraculous enough in itself, it was a tiny third-height device! The only potential down side to this drive was the interface. At long last I'd have to

delve into the mysteries of SCSI. Yikes. Fortunately, a few phone calls to techies far more learned than myself yielded some encouraging news. A SCSI interface was no longer necessarily a configuration nightmare. The trick was to get the right stuff, and get it we did: an Adaptec 1542C Host Adaptor, along with the same company's EZ-SCSI software. In addition to its SCSI capabilities, the 1542C offered a pair of standard floppy disk drive connectors. These would be used to activate the 1.2Mb 5.25 inch and 1.44Mb 3.5 inch Panasonic floppies. What a SCSI card lacks, and which are taken for granted on IDE cards, are serial and parallel ports. That being the case, I had hoped to equip the system with one of those nifty new bidirectional high-speed parallel ports. This proved to be an elusive goal, and finally, in the interest of expedience, I settled for a generic IDE controller/serial/parallel card.

Wanting this to be an up-to-date system, I had previously got hold of an MPC-compliant CD-ROM reader of indeterminate brand. This anonymous device came with its own interface card. Once the specter of SCSI loomed in the distance, I jettisoned that CD-ROM in favor of a suddenly-available NEC Intersect CDR-84, which would — the theory went — be driven by the SCSI adaptor. The bonus here was that the NEC would provide far better performance as well. I decided to hold the question of sound in abeyance.

I've long held that the best mouse is a bus mouse, and planned to transplant my own Microsoft InPort bus mouse into the new system. A similar fate awaited the Intel SatisFAXtion 400 fax/modem — in my experience, the first internal modem whose performance and overall lack of gremmils outweighed the absence of an on/off switch.



Just as in cooking, when you do it yourself it never quite looks as neat as it does in the picture. Here, the ribbon cables from the SCSI card to all the drives were tortuously snaked around components.

Although the Micronics board was fitted with local bus slots, the video system chosen for the system was a standard ISA card: Video7's WIN.SWIFT. I'll have more to say about this selection later on!

The vessel into which all of these parts would be fitted was a nameless mini-tower case. It was prefitted with a 230-watt power supply, and came with a bag of small parts intended to facilitate the installation of the various components.

A Trial And (Mostly) Error Process

With no instruction manual to guide me, I turned to friends at a local computer store. After making a se-

ries of suitably insulting remarks about my lack of skills, they suggested that the motherboard be installed first. This involved inserting the ends of four nylon "feet" into holes on the board, and the other ends into (mercifully) corresponding holes in the system chassis. Doing so quickly revealed the first potential drawback to using a mini- rather than a full-size tower: the third-height drive bay sub-chassis blocked full access to two of the expansion slots. This in itself wouldn't be awful: half-length cards would fit fine. The real problem (at least in theory) lay in the fact that one of the blocked slots was a VESA slot. Fortunately, at this stage of the process I didn't have even one, let alone two VESA cards.

I ought to say something here about jumpers, just in case you techies think I'm a complete idiot. The MX30 has plenty of them, along with very cogent instructions as to their function. I studied the manual, and determined that all the factory settings were correct, and that was the end of it.

Once the motherboard was firmly in place I realized that its RAM slots were still empty. The problem was, I couldn't get away with using readily-available (i.e., scroungeable) 1Mb SIMMs. The sockets were configured for 36-bit modules: 8Mb would come in the form of a pair of 1x36 modules. A few frantic phone calls caused the aforementioned 8Mb to appear at my door, and they slipped into place without any fuss at all. The next step was to deal with some of the multi-colored two-conductor wires that connected the speaker, turbo and reset switches, turbo LED, and key lock to the motherboard. All of these were nicely labelled on their plugs, and the motherboard manual clearly indicated where each should go. Because the motherboard was equipped with a Dallas real-time clock/battery backup, I didn't need to connect the external battery case that was supplied with the chassis. The last connections to the motherboard were the two power supply plugs.

Sometimes "Third-Height" Is Just A Bit Higher

Viewed from the front, the system is equipped with three half-height drive bays, below which are a pair of third-height bays. In theory, this is a perfect arrangement: with the CD-ROM and 5.25-inch drive occupying the top two bays, and the 3.5-inch floppy and hard drives the bottom two, a half-height bay would remain open for an internal tape backup system, to be acquired sometime in the future. Alas, this was not to be, for while the

Quantum PD1225's *width* allowed it to fit within the confines of a third-height bay, its height was just great enough to prevent the floppy drive from occupying the second bay. My search for an internal tape drive could be put off indefinitely.

Note that before installing the hard drive I studied the manual in order to determine the proper position for the jumpers which determine the SCSI ID number and various other aspects of its configuration. As it turned out, for the hard disk to be SCSI ID 0, and *not* be the last device in the SCSI chain, all of the jumpers had to be removed.

Since all I had left were half-height bays, it became necessary to fit the tiny 3.5-inch floppy drive with an adaptor. This was a simple screwdriver job, as was attaching the finished assembly into the bottom of the three bays. Above it went the 5.25-inch drive, again secured with four screws.

A Tight Squeeze

With the two floppy drives installed, I turned my attention to the NEC CD-84. Its SCSI ID number is determined by the position of a DIP switch array, and since the hard drive was to be 0, I stuck with NEC's default, which was 1. That having been dealt with, I positioned the drive at the front of the topmost bay and began to apply pressure in an attempt to slide it into place. After a moment or two of futile effort I recalled the phrase "don't force it, get a bigger hammer." My solution — which, by the way, I'm not necessarily *recommending* — was to spray some silicon lubricant on a rag and wipe the side walls of the drive bay. That did the trick: I slid the CD-ROM into position, and secured it with the usual four screws.

Speaking of screws, it's a good idea to follow the drive manufacturers'

recommendations regarding thread configuration and — especially — length. If the screws are too long they might touch things they oughtn't to, with potentially nasty results. You might ask, "If the right screws are so important, why don't they just supply them?" I don't know.

With all of the drives in place, the next step was to plug in the power cables, dozens of which seemed to sprout from the power supply at the top-rear of the cabinet. It turned out not to be dozens, but there were plenty to go around, with plugs in sizes to accommodate both large and small sockets.

A Stack Of Cards

With the mechanical assembly (mostly) done, I had to configure and insert the five expansion cards. Since the SCSI card would have all sorts of ribbon cables leading up to the drives, I decided that it should occupy Slot 1, at the top. According to the Adaptec Installation Guide, all of the factory default settings — port and BIOS addresses, floppy drive connectors, etc, corresponded to my needs, so I inserted the card into place. Now came the messy part: attaching the ribbon connectors to the four drives. The good news was that the plugs were keyed, so I couldn't insert them backwards. The bad news was that the SCSI cable was *far* too short to extend first to the hard drive, and then to the CD-ROM reader. One solution to this problem would be to somehow acquire a sufficiently long SCSI cable. It being Sunday, this was out of the question. The more expedient approach was to fire up the power screwdriver and shuffle the drives. I left the 5.25-inch drive in the middle, and swapped the CD-ROM and 3.5-inch drives. All of the ribbon cables now reached their marks, albeit after some fairly tortured twisting and turning

the likes of which you don't see in store-bought systems. I guess when you're building hundreds of the same model you can order custom cables that fit exactly right, and which can be routed to look neat in case the customer (or a reviewer) looks inside the cabinet.

I decided to allow Slot 2 — the first VESA slot — to lay fallow for the time being. Since there were fewer cards than slots, there would be no need to crowd the Adaptec card, with its frightening array of ribbons sprouting in all directions. Despite the fact that it didn't take advantage of the VESA portion of Slot 3, I decided to place the Video Seven card in that position. That way, if a VESA card eventually became available, switching the two would be simplified. Consistent with the leapfrog approach, I placed the SatisFAXtion 400 in slot 5, silently thanking Intel for designing it without jumpers or switches.

Slot 6 was devoted to a last-minute acquisition: a full-length card on which were mounted a pair of fans, one pointing in each direction. Despite its hefty heat sink, I was concerned about the processor's high operating temperature. (Indeed, I've heard about 486 processors being used to fry eggs — small eggs, to be sure, but eggs nonetheless — by hackers too busy to go out to lunch.) Fortunately, The Micronics motherboard's layout was such that one of the card's fans blew directly across the processor, allaying my concerns.

This left two slots, and two cards: the serial and parallel I/O, and the InPort mouse. Before installing the former into Slot 7, I spent a good fifteen minutes coping with its 15 configuration jumpers. In a "normal" system, this wouldn't have been necessary: the factory presets would have been correct. For my purposes, how-

ever, the IDE and floppy disk controller had to be disabled, along with the game and COM2 ports. I decided to forego a second serial port because the SatisFAXtion card was going to use one of the COM addresses, and I didn't want to cope with the potential conflicts involved with having three COM ports. The default interrupt setting for the parallel port (IRQ7), and COM1 address (3F8-3FF) seemed benign enough, so I left them alone. The mouse card had served me well over the years with its jumper set for IRQ5. Seeing no reason to make any changes, I slid it into Slot 8.

Battening Down The Hatches

From a mechanical standpoint, all that remained to be done was snap the front panel on to the chassis, and install the cover. Unfortunately, the CD ROM reader's hinge panels stuck out too far to allow the front panel to fit. In the absence of a rotary grinder, I used a utility knife to crudely gouge out sufficient plastic from the front panel to allow it to be fitted into place. The metal cover, thank goodness, slid into place without protest and, the heavy work done, I settled in for a well-deserved nap.

Now, The Hard Part

With all of the components in place, I began to identify with Dr. Frankenstein. My job was to take a collection of inert components and, with the aid of some well-placed electricity, bring them to life. Having never dealt with SCSI issues, I wasn't quite sure how it all was supposed to come together, but with high hopes I placed an MS-DOS 6.0 disk in Drive A (which, modern kind of guy that I am, was the 3.5-incher), stood back about ten feet, and prevailed upon a convenient innocent bystander to hit the power switch. *Mirabile dictu*, drive and fan

motors commenced to turn, and hitherto dark lights began to glow. It lives!

I rushed to the monitor, and saw the video card and system BIOS (Phoenix) notices, followed by the memory check. Resisting the urge to halt the latter with a keystroke, I was reassured to see the full 8Mb check out OK, and then to read that the system's 256Kb of SRAM cache had been recognized as well. Then, the real miracle occurred: the Adaptec's BIOS kicked in, poked around for a bit, and reported *the make and model number of both the harddrive and CDROM, along with their SCSI ID numbers*. This, I thought to myself with true Frankensteinian hubris, was going to be a snap.

Feeling on more-or-less familiar ground, I set about partitioning and formatting the hard disk, and loading MS-DOS. This is a nearly automatic procedure with MS-DOS 6, once the decision regarding partitioning has been made. Up to this point, I've always set up my hard disks with a single partition. This makes for much simpler housekeeping and, since I've never had a drive larger than 340Mb, hasn't been too wasteful in terms of slack. So, when the DOS FDISK utility reported 1Gb available, and asked how I wanted to set it up, I told it to give me one big C:\ drive. And, figuring that 1Gb was the reporting limit of poor dumb old MS-DOS, I assumed that the missing 200Mb would appear at the end of the process. When the formatting and DOS installation were finally complete, the system rebooted — from the hard disk, hallelujah — and what do you know: the missing 200Mb was still missing.

Time To Read The Manual

Here's the deal: for Great Big Drives (the technical term) of 1Gb or greater,

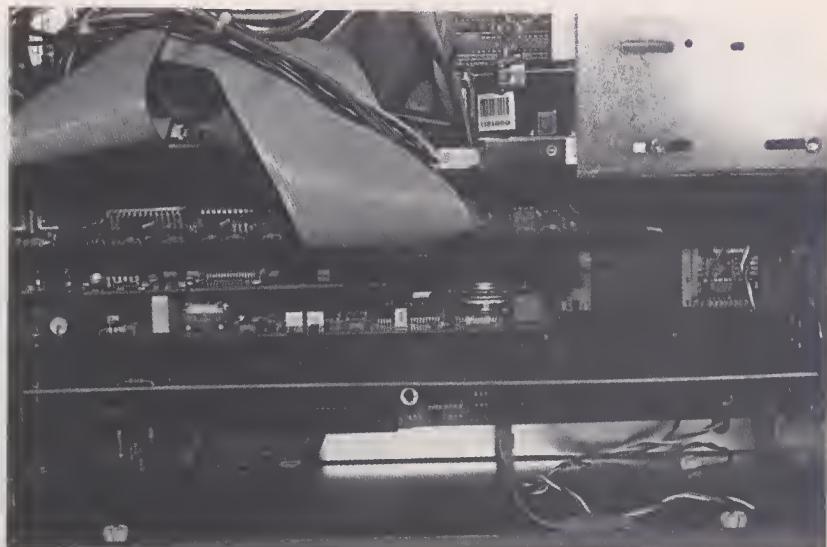
something called Extended BIOS Translation had to be activated within the SCSI adaptor.

I learned of this, in a highly uncharacteristic fashion, by looking through the Adaptec manual. Enabling this feature turned out to be very easy: hitting CTL-A when prompted to do so during the boot-up process brings up Adaptec's BIOS-based *SCSISelect* utility. Enabling Extended BIOS Translation was one of the options in the advanced setup menu. Of course, now that the BIOS was set to fool DOS about heads, sectors, and the like, the drive had to be partitioned and formatted all over again, and DOS re-installed. An inconvenience, to be sure, but another hour or so of thumb-twiddling was a small enough price to pay for an extra 200Mb of storage.

Once the drive was formatted and capable of booting the system, I did what I always do to a new computer: install *XTree Gold*. (If you don't know about this program, you're probably spending way too much time and energy on disk management.) Running that estimable program reminded me of two things — one of which I already knew, but whose ramifications suddenly became much more personal.

The first was that *XTree*'s disk statistics windows only accommodate nine-digit numbers. The available space on a 1.2Gb drive, with most of its space still unoccupied, is reported as #####. Not a big deal, however, since once the disk gets loaded with files, the numbers drop to reportable levels. The second thing I had neglected to consider was slack — unused disk space that, because of the way DOS handles files, is unavailable.

The factor that determines slack is cluster size, for it describes the minimum amount of *actual* space taken up by a file containing even a single byte



The card at the bottom of the photo contains two fans which keep the interior of a 486 system cool. The SCSI cable was too short and the drives had to be moved to accommodate position one for the SCSI card. The point of view is looking down from overhead.

of data. Now, my previous systems, with their relatively small 2-300Mb drives, had 8Kb clusters. This meant that a text file consisting solely of, for example, my name would be reported by DOS as containing 15 bytes, but would actually "lock out" 8192 bytes of hard disk space. Without getting too technical, the consequence of partitioning a 1.2Gb disk as a single, enormous C:\ drive was a cluster size of 32Kb. Clearly, this would lead to a colossal waste of space, so I decided to bite the bullet and, once again, go through DOS' partition/format/installation routine. This time I established a primary partition — drive C:\ — of 332Mb, and divided the extended partition into three additional logical drives — D:\, E:\, and F:\ containing 337Mb, 337Mb, and 173Mb respectively.

Bringing the CD-ROM to Life

That the SCSI controller recognized the CD-ROM reader wasn't sufficient to make it available for use. Attempting to log onto drive G:\ resulted in the dreaded "Invalid Drive

Specification" message. This was not unexpected: I knew that the Microsoft CD-ROM Extension, in the form of a program called MSCDEX.EXE, had to be loaded before MS-DOS would recognize a CD-ROM drive. Adaptec's EZ-SCSI program placed the necessary line in the AUTOEXEC.BAT file, along with another in CONFIG.SYS.

Unfortunately, rebooting with the obligatory lines in place didn't seem to bring the CD-ROM any closer to usefulness. The problem, it turned out, was that the copy of MSCDEX.EXE supplied by Adaptec wasn't compatible with MS-DOS 6.0. Using the copy that came with MS-DOS 6.0 did the trick, but not before I jumped through a couple of hoops involving the vagaries of DOS' SETVER program.

The FAX/Modem And Its Software

Having used Intel's SatisFAXtion 400 with great success in several systems, I didn't anticipate any difficulties in setting it up in the new one. All of the

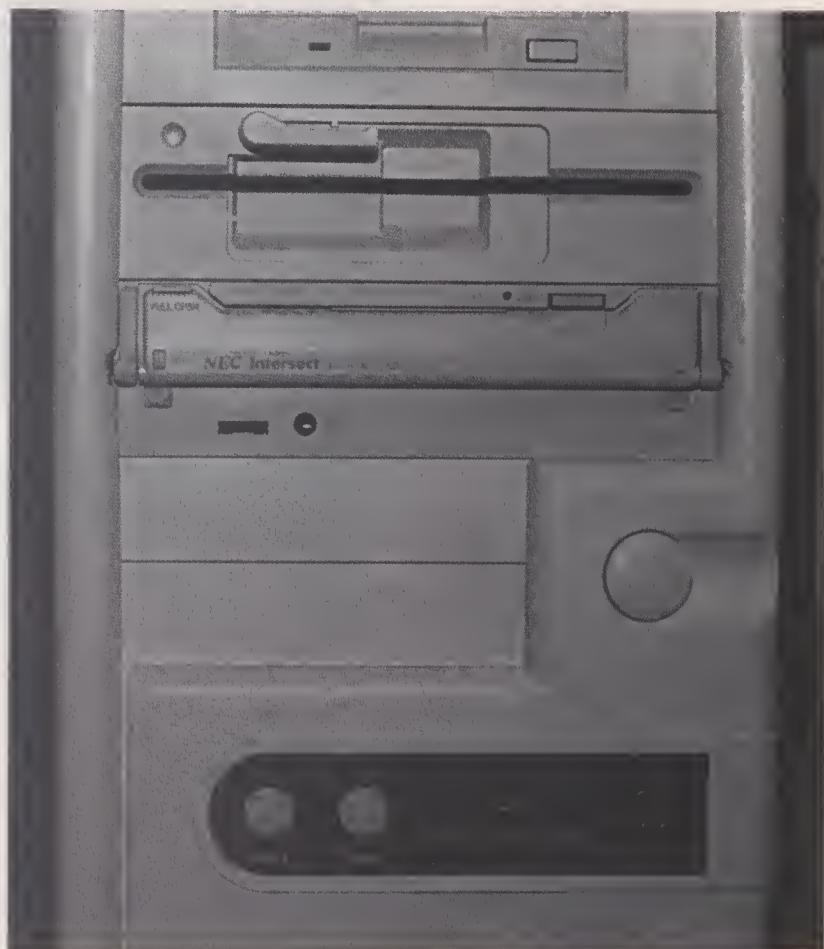
board's variables — interrupts, port addresses, etc., — are set in its EPROM by the installation software after it surveys the system and determines what's available.

The default interrupt for the FAX portion of the board is IRQ10, while that used by the modem will vary depending on which COM port is to be used. Since I had only installed one serial port, the Intel setup routine set up the modem as COM2, using IRQ3. The setup program made its changes to the board's EPROM, added the required lines to my startup files, and told me to reboot in order to implement the installation. I did so, and noted with dismay that the FAX board driver — loaded from within CONFIG.SYS — wasn't able to find the board. Consequently, the CAS Manager program, which was part of the AUTO-EXEC.BAT file, wasn't loaded either. This was bad. Fortunately, Intel's tech support was very good.

After several of the simpler solutions failed to work, we determined that IRQ10 was not available for the SatisFAXtion's use. A call to Micronics confirmed that this was, indeed, the case. Not really needing to know the answer, I didn't ask why. Besides, I truly believed that a full explanation might have caused my head to explode.

The bottom line was that I would have to select a different IRQ, from a list consisting of 2,3,4,5,7,10, and 11. This was not, I hasten to add, the list of *available* interrupts, but rather of those the SatisFAXtion 400 was capable of addressing.

Most of them, of course, were already in use or otherwise unavailable. We — the Intel guy and I — finally decided to let the fax use IRQ5, and to switch the InPort mouse to IRQ2. This seemed to work: upon rebooting the fax software reported that all was well.



Look closely at the NEC CD-ROM reader, left and right edges, and you can see where Drucker, in a move unprecedented in the annals of system assembly, used his penknife to make the drive fit into the bay!

Adventures in Memory Land

To this point the only step I had taken to conserve lower memory was to load MS-DOS into upper memory (using the CONFIG.SYS line DOS=HIGH). That being the case, the various SCSI, CD-ROM, FAX, and Mouse drivers and TSRs were all being loaded into the first 640Kb of RAM. If I had any intention of running actual applications on this system, it would be necessary to employ some serious memory management techniques. Rather than recount the whole traumatic process, I'll simply list some of the highlights, along with

the final results.

1. DOS' MEMMAKER turned out to be surprisingly competent. I would recommend it to owners of less elaborate systems — those with IDE drives and a smaller collection of drivers and TSRs.

2. The 6.02 version of Quarterdeck's QEMM386, which I had been using with great success on MS-DOS 5.0-based systems, couldn't cope with MS-DOS 6.0. Neither, as it turned out, could version 7.0 once I managed to secure a copy. What I needed

turned out to be the 7.01 patch.

3. For reasons that aren't yet clear to me, QEMM's "Stealth" routines—which relocate ROM BIOS in order to free up extra lower RAM—don't work with this machine.

After several hours, and dozens of system reboots, I wound up with a set of startup files that yielded a sufficient amount of lower memory. Of course, these files changed as various applications were installed. For your information, their *present* state—which yields 588Kb of lower RAM for applications, is reproduced below. I'm reasonably certain that someone with a thorough understanding of QEMM's frighteningly complex command-line structure could, after hours of experimentation, eke out another 10 or 20Kb. But not me. I'm told Memory Commander from V communications is simple to use, but that will have to wait for our next issue.

At this point the hardware and system software was sufficiently stable to allow me to consider filling the hard drive with programs. After a glass of cognac, followed by a half-hour nap, that's just what I did.

Fill 'er Up

When configuring a new computer I generally port the bulk of the DOS-based applications, along with fonts and data files, to it from the old one, using Rupp Corporation's *FastLynx*. In this instance I was planning to use the D:\ drive for DOS programs, so this type of file transfer would result in a spate of "file not found" type errors when running the applications. WordPerfect, for instance, has a "Location of Files" dialogue box that contains the subdirectories in which the various program modules are to be found.

Mr. Drucker's System Startup Files

These are my own personal autoexec.bat and config.sys files. They are a combination of lines added to the files by individual applications, utility programs meant to enhance performance, and my own tricks that have evolved over the years from reviewing systems.

AUTOEXEC.BAT

```
C:\QEMM\LOADHI/R:2 C:\DOS\MSCDEX.EXE /D:ASPICD0/L:G/M:12
C:\DOS\SMARTDRV.EXE
C:\QEMM\LOADHI/R:3/RES=15680/SQF D:\PCACHE\PCACHE
@ECHO OFF
PROMPT$P$G
SET
PATH=C:\QEMM;C:\NDW;C:\WINDOWS;C:\DOS;C:\UTILITY;C:\FAX;
D:\OFFICE30;C:\ALDUS;C:\PM4;C:\FAX\CAL\BIN
PATH D:\NU;%PATH%
SET SYMANTEC=D:\SYMANTEC
SET NU=D:\NU
SET TEMP=F:\TEMP
C:\FAX\CASMGR.EXE C:\FAX\CASMGR.CFG
C:\FAX\FAXPOP.EXE
D:\NU\ND C: D: E: F: /Q
D:\NU\IMAGE C:
SHELL
```

CONFIG.SYS

```
DEVICE=C:\QEMM\DOSSDATA.SYS
DEVICE=C:\ADAPTEC\ASPI4DOS.SYS/D
DEVICE=C:\QEMM\QEMM386.SYS RAMR:5
DEVICE=C:\QEMM\DOSS-UP.SYS@C:\QEMM\DOSS-UP.DAT
BUFFERS=30,0
FILES=50
LASTDRIVE = G
FCBS=4,0
DOS=HIGH
DEVICE=C:\QEMM\LOADHI.SYS/R:2C:\FAX\SATISFAX.SYS
IOADDR=0340
STACKS=0,0
DEVICE=C:\QEMM\LOADHI.SYS/R:2C:\ADAPTEC\ASPICD.SYS/
D:ASPICD0
SHELL=C:\QEMM\LOADHI.COM/R:2C:\COMMAND.COM C:\P
```

The first and fourth lines of the CONFIG.SYS file were created by QEMM. I have no idea why they're there, or what they do. (Everything else makes a certain amount of sense, which, come to think of it, is kind of scary.)

After a moment or two of contemplation I decided that updating the pointers in my DOS programs would be far less time consuming than reinstalling them from floppies. A further consideration was that reinstallation would mean losing various "preference" settings unless I were able to

save the old "set" files and use them with the new installations.

The *FastLynx* file transfers went smoothly, as always, and once all of the DOS applications had been copied I ran the *WordPerfect Library Shell*—my DOS application launcher—and made the necessary file loca-

tion changes. I was most gratified to see that all of my DOS programs ran fine once they were made to understand where everything was.

Our Famous Real World Benchmarks

The system seemed to be stable in the DOS domain, so before tackling the far more challenging task of installing Windows and its applications, I decided to run *PC Upgrade's* Real-World Benchmark Tests. (For an explanation of the tests, see next page.) When the smoke cleared, the scores placed this machine at the very top of the list: I had never tested a faster computer. Here are the results:

TEST	SCORE*
db1	17
db2	1
db3	0
db4	11
db5	5
db6	4
wp1	2
wp2	7
wp3	3
lotus1	3
lotus2	2

* In seconds. Lower scores mean faster performance.

And Now, Windows

Of course, these days getting a computer to run DOS programs is a day at the beach. Whipping an elaborate Windows installation into shape is another thing entirely. My own fairly tortured Windows configuration includes several major applications (including *Corel Draw 4.0*, *Aldus Page-Maker*, *Micrografx Designer* and *Works*, Computer Support Corporation's *Arts and Letters*, and *WordPerfect for Windows*) and several dozen secondary programs. I further complicate matters by having several hundred typefaces in both TrueType and PostScript format, with the latter un-

der the control of *Adobe Type Manager*. And, just to keep things interesting, instead of the Windows Program Manager, I use *Norton Desktop for Windows* as my operating shell.

With all of this in mind, I inserted Windows Disk 1 into the 3.5-inch A:\ drive and typed SETUP. The only non-standard aspect of the installation involved substituting the Video Seven WIN.SWIFT display drivers for those supplied by Microsoft. I set the display for 1024x768, with 256 colors, and proceeded with the six-disk setup. The installation went smoothly, and when it was over, Windows ran fine. Over the next several hours I loaded the rest of my Windows programs, saving *NDW* and *ATM* for last. The *Norton Desktop* installed fine, but when it came to load *Type Manager 2.5* I ran into trouble. The program appeared to install properly, but once it was on the system, Windows wouldn't load. Instead, the screen reported that PROGMAN caused a General Protection Fault, named the display driver, and pointed at a specific memory address. This wouldn't do at all! I removed *ATM* from the system — the manual provides excellent information in that regard — and Windows ran fine. I had several earlier versions of *Type Manager* laying around and, on a hunch, installed one of them. Bingo: Windows ran without a problem.

I should interject, at this point, that during this fairly lengthy troubleshooting process I was in regular contact with both Microsoft and Adobe tech support, and received a great deal of good, albeit futile, advice. At the same time, suspecting that the display card might be at the root of the problem, I was trying to make contact with Video Seven. Theoretically, that company has a toll free tech support line, a tech support fax line, and a bulletin board.

Over the course of two weeks, the tech support line was answered by a voice line system that reported itself unable to accept messages. Neither the fax, nor the BBS answered at all.

To recap, then: everything is working more-or-less properly, except that I can't use the latest version of *ATM*. All of the major applications seemed to be running all right until I loaded a PageMaker file that — the last time I looked — had some white type on a black background. Now, just the background showed. Changing the display from 256 to 16 colors solved that problem, but it was manifestly clear that the fancy WIN.SWIFT card would have to be jettisoned. In its place I installed a very inexpensive Tseng 4000-based Cardex W32 VL-BUS card whose performance and stability are all that I could have hoped for. It allowed me to install *ATM 2.5*, and displayed white-on-black in 256 color mode.

More To Come?

I am, quite frankly, tickled pink with this system. It's fast, it's stable, and — despite my having loaded it with virtually every bit of software in the house — it has nearly 700Mb of available disk space. You'll note, however, that despite the zippy CD ROM, the system isn't multi-media equipped. Frankly, the very thought of dealing with the configuration nightmares involved in installing a sound board makes me want to jump on my motorcycle and disappear. I have nightmares about IRQ conflicts. On the other hand, disks like Microsoft's *CineMania*, with its huge collection of classic movie sound bites, make the notion seem a little more palatable. One day, when I'm feeling strong and clever, I may make the attempt. In the meantime, though, leaving well enough alone doesn't seem like too much of a sacrifice. ■

REAL-WORLD BENCHMARK TESTS EXPLAINED

PC Upgrade's equipment tests are conducted using Bedford Communications' proprietary suite of benchmark tests. An explanation of these tests follows.

dBASE IV	Test 1 Index 10,000-record database 3 times on 3 different fields—1 text, 1 numeric, and 1 date. Measures hard disk and memory performance. Test 2 Append blanks 300 times to 300 records. Tests memory performance. Test 3 Locate 55 records in a 1,300-record database. Measures hard disk performance. Test 4 Perform 16,000 Stores. Tests total system performance. Test 5 Perform 3,700 Gets. Tests memory and CPU access. Test 6 Open and close a database file 300 times. Measures hard disk performance.
WordPerfect	Test 1 Search 19,000-word document for "and" and Replace with "AND," then reset and Replace "AND" with "and." Tests memory and CPU performance. Test 2 Spell Check 19,000-word document. Tests general system performance. Test 3 Change type size of entire 19,000-word document from 12 points to 9 points, repaginate, then reverse process and repaginate. Tests general system performance.
Lotus 1-2-3	Test 1 Recalculate large financial report based on changes in first-year figures. Very memory intensive. Test 2 Perform multiplication on matrix. Uses matrix in which each cell is random multiple of preceding cell. Memory intensive.
Windows Applications	Test 1 Open PageMaker document, scroll story editor, rearrange text and graphics, change styles, open and close file several times. Tests hard disk, processor, and video performance. Test 2 Start PaintBrush, import large graphic, scroll, change colors, and rewrite screen many times. Tests mostly video performance in Windows.

Products Mentioned

Adaptec AHA-1542C
 SCSI Host Adapter
 Adaptec, Inc.
 691 S. Milpitas Blvd
 Milpitas, CA 95035
 (408) 945-2550

Quantum ProDrive PD1225
 Hard Disk
 Quantum Corporation
 500 McCarthy Boulevard
 Milpitas, CA 95035
 (408) 894-4000

Micronics MX30 VL-BUS
 Motherboard
 Micronics Corp.
 232 E. Warren Avenue
 Fremont, CA 94539
 (510) 651-2300

NEC Intersect 84
 CD ROM Reader
 NEC Technologies, Inc.
 159 Swanson Road
 Boxborough, MA 01719
 (508) 635-4000

Intel SatisFAXtion 400
 Fax/Modem
 Intel Corporation
 5200 NE Elam Young Parkway
 Hillsboro, QR 97124-6497

Microsoft InPort Mouse
 Microsoft
 One Microsoft Way
 Redmond, WA 98052
 (800) 426-9400

Xtree Gold 2.55
 File Management Software
 Xtree Corporation
 4330 Santa Fe Road
 San Luis Obispo, CA 93401
 (805) 541-0604

QEMM 7.01
 Memory Management
 Quarterdeck Office Systems
 150 Pico Boulevard
 Santa Monica, CA 09405
 (310) 392-9851

Memory Commander 4.0
 Memory Management
 V Communications
 4320 Stevens Creek Blvd, Suite 275
 San Jose, CA 95129
 (408) 296-4224

Adobe Type Manager
 Adobe Systems
 1098 Alta Avenue
 P.O. Box 7900
 Mountain View, CA 94039-7900
 (415) 961-4400

Norton Desktop for Windows
 Symantec Corporation
 10201 Toree Avenue
 Cupertino, CA 95014-2132
 (408) 253-9600

Gearing Up For Your Multimedia Presentation

Yes, it can be done. You can create a solid selling tool that includes sound, music and motion in your own home, just by adding a bit more to your budget and a lot more to your patience.

Ted Needleman

You've made up your mind. You've been embarrassed for the last time. Your presentation to your boss and the heads of the other departments was drowned out by the snores of those who dozed off in the middle of it. You have another presentation to make in two weeks, and this one will be different. This next presentation will use the computer to wake up everyone, and keep them awake! But where do you start? What do you need?

Putting together a knockout multimedia presentation isn't all that difficult. But it does take some preparation, and the right hardware and software tools. Here's a few solutions you can quickly and economically add to your arsenal. We'll even throw in a few tips on perfecting your presentation skills.

Building Your Hardware Platform

Regardless of how fancy you intend to get with your presentation, there is a minimum hardware setup that you're

going to need to create and deliver a multimedia extravaganza. Just how far overboard you want and need to go depends a lot on both what you want to accomplish, and how deep your pockets are. The Multimedia Product Council (MPC), a consortium of vendors developing hardware and software for the multimedia market, have defined two levels of "standards" for a multimedia equipped system. Level one, the original standard, requires a sound card, CD-ROM player with 350MS access and 150KB/sec data transfer rate, and at least a 386 CPU. The Level 2 specification, released recently, ups the ante a bit by requiring a 486SX CPU, double speed CD-ROM drive, 16-bit audio, and super VGA video.

That's what the MPC specs are. What you really need can be quite a bit different. If you intend to fill a large space with professional quality sound, or compose your own musical scores to accompany your visual presentation, chances are you'll want a sound board that supports MIDI, a special serial network scheme that allows

electronic musical instruments to "talk" to each other, or even control another instrument. On the other hand, a less ambitious scenario might have you lugging a notebook to a meeting, and making a presentation from the desktop. It's certainly possible to accomplish this with just the speaker and display built into the notebook, but you can also add on a variety of portable products that considerably enhance the experience. Let's take a look at several approaches.

A One Box Solution

One of the best solutions for getting into the creation of multimedia presentations is to add an upgrade kit to your PC. Of course, this only works with desktop PCs, not notebooks. We'll give you some alternatives for portable use a bit further on.

There are more than a dozen vendors offering multimedia upgrade kits, and except for some variation between specific sound boards and software provided, they tend to be fairly alike. There are a number of things to



For those of you who have been hibernating, pictured above is the latest in multimedia systems as approved by the Multimedia Marketing Council. It must come complete with speakers, double-speed XA compatible CD-ROM drive, 16-bit sound board, SuperVGA monitor, 4Mb of RAM and a 170Mb hard disk.

look for at a minimum. Depending on whether the kit meets MPC Level 1 or Level 2 specs, look for a CD-ROM drive that provides either a 350MS access and 150 KB/sec data transfer rate, or double-speed drives that provide access times in the area of 200MS with 300 KB/sec or better data transfer rates. Most multimedia upgrade kits have CD-ROM drives that plug into the sound card. The controllers on the sound card can be either AT-bus compatible (which the largest number of drives are), or SCSI. SCSI gives better performance, but costs more and may interfere with other SCSI interfaces in the PC, such as those used for large hard disks, Bernoulli Box drives, or many page scanners.

Sound cards also vary greatly in features and capabilities. At a minimum, older sound cards still use 8-bit technology. They have fewer voices (instrument sounds) and cannot per-

form digital sampling at the high rates more sophisticated cards are capable of. Most sound cards today are 16-bit boards. They have fairly high sampling rate capabilities, 20 or more voices, and frequently have both joystick and MIDI capability. Look for compatibility with the most frequently used standards, Ad Lib, Sound Blaster, and Disney Sound Source. Leading edge technology incorporates Wave Tables. These are actual instrument sounds that have been digitally sampled and stored in ROM, special RAM on the card, or on disk. Wave Table technology provides the most realistic instrument voices, and is the technology used in the most expensive music synthesizers.

Finally, look at the accessories the upgrade kit provides. These greatly influence how much use you'll be able to get out of the kit, and include various software packages and programs on CD-ROM, cables such as

MIDI connectors and adapters, and even microphones, headphones, and speakers. It's really frustrating to set up a new multimedia upgrade kit, and not really know if it's working or not because you don't have a set of speakers or headphones.

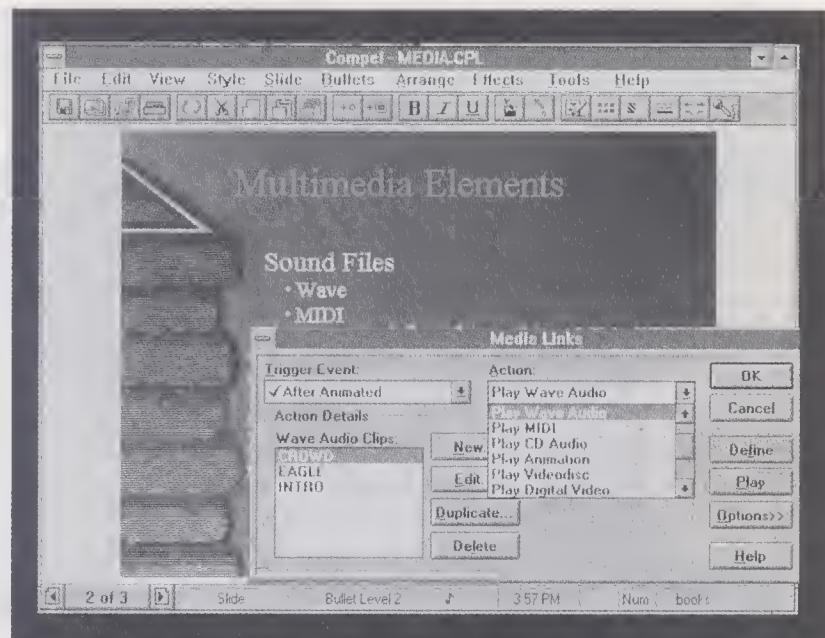
One of the newest upgrade kits we examined is the Sound Galaxy Pro 16 from Aztech Labs, Inc. A Level 1 upgrade kit with a list price of \$639 (which should translate to a street price of about \$475 or so), it includes an internal CD-ROM drive, the Sound Galaxy NX Pro 16 sound card, lots of software, and even a set of earphones and a microphone. Just about everything you need to get started using and even creating your own multimedia applications.

We did not encounter any problems in installing the upgrade. The Mitsumi CD-ROM drive installs in a half-height slot pretty much like any other drive. If you have a PC that

requires the use of drive rails for mounting a drive, make sure that you obtain a set elsewhere (like Radio Shack or the computer dealer where you buy the upgrade), as the kit does not include these. Once the drive is mounted, you can insert the Sound Galaxy NX board and plug the 40-pin cable from the CD-ROM drive into the card. There's also a 4-pin cable for the audio that needs to be connected between the card and drive. There are a number of jumpers on the Sound Galaxy card that may have to be moved depending on your configuration. We left all the jumpers at their default positions with no problems.

Software is installed from both disk and CD-ROM. The driver software and over a dozen utilities are loaded from disk. In all honesty, these utilities are pretty much the same fare you get with most multimedia upgrade kits. There's a volume control program, and a DOS-based track player. About the only utility that's substantially different is the one that lets you enable and disable the unit's Disney Sound Source and Covox Speech Thing compatibility.

Aztech doesn't give you quite as large a selection of CD-ROMs as some other vendors. But the ones that they give you are ones that you'll like and use. The Toolworks Multimedia Encyclopedia is terrific, and is actually the New Groliers Multimedia Encyclopedia in OEM dress. There's also a terrific World Atlas from The Software Toolworks, and Interplay's Battle Chess. Even if you're not a chess player, it's fascinating to see the pieces battle it out. Finally, there's a copy of MACROMEDIA's Action 2.0. Action is a popular multimedia authoring package that lets you quickly knock out your own multimedia presentation. It's very similar in both function and features to Asymetrix COMPEL, reviewed a bit



Compel offers a full range of presentation and multimedia authoring tools for a \$295 list price.

further on, but without Compel's extensive media clips. We prefer using the Asymetrix product, but there are lots of very happy and loyal Action users. It's largely a matter of personal preference and which package you use most frequently.

As with all of the packaged upgrade kits, the ultimate value depends on how much or how little of the particular bundle you'll use. The Sound Galaxy is no more complex to install or use than of the multitudes of other upgrade kits. Because many of the parameters can be set through software, it may be easier to get running than many. Aztech Labs gives you a fairly nice bundle of software, both on disk and CD-ROM, but in reality, a lot of it would never be used by many users. This, however, is just as true of the bundles offered by other vendors.

Where the Sound Galaxy really does stand out, though, is in the across-the-board compatibility it offers. Many sound cards are compatible with Ad

Lib and/or Sound Blaster. Aztech adds the Disney Sound Source, Covox Speech Thing, and even Microsoft Sound System. Again, how important this capability really is depends on what applications you use and want to use, but it does offer a great deal of flexibility should you need it. For the money, the Aztech Sound Galaxy Pro16 Multimedia Upgrade Kit is a very good value, and an excellent way to get your PC up to MPC Level 1 specs.

Take It On The Road

Multimedia upgrade kits are the easiest way to get up to speed hardware wise, but do you need to forget about multimedia if you're a notebook user? Of course not, but it's not quite as easy or inexpensive as upgrading a desktop unit.

Assuming that you'll live with the notebook's screen or will be using an external monitor, there are two other hardware areas that need to be ad-

dressed: CD-ROM, and sound. While it's not as inexpensive as an internal unit meant to be mounted in a desktop PC, the backpac CD-ROM drive, \$499, from Micro Solutions Computer Products runs from the parallel port of any PC, and installs in about two minutes. Actually, at 6" (W) by 10.5" (D) by 2.25" (H), and 5 pounds plus another pound for the AC supply, the backpack drive is not only about the same size as many notebooks or subnotebooks, it also weighs about the same as well.

The backpack uses the popular Mitsumi drive. This is the same caddieless drive that's often found in many of the multimedia upgrade kits (including the Aztech kit just reviewed), and with access times of 350MS and a data transfer rate of 150KB/sec, it meets the MPC Level 1 spec. In addition, the unit is multisession compatible, and has been certified by Kodak as being compatible with Photo CD standards.

Setup shouldn't take more than a minute or two. The power cube plugs into the AC outlet and the back of the unit. The cable from the backpack is plugged into the parallel printer port of your PC or notebook, and the printer, if one is used, is plugged into the pass-through port in the rear of the drive. The software has an automated install routine which copies the required files to your hard disk and places the needed commands in your AUTOEXEC and CONFIG.SYS files. The whole process takes about 45 seconds, and when you reboot you're ready to use the CD-ROM drive. One additional benefit of the backpack CD-ROM drive is that although it's a bit more expensive than some internally mounted drives, it can easily be used with several different PCs. Just move it from one to another as needed.

Once the software driver has been installed, the backpack works just

like any other CD-ROM drive. It's assigned the next available drive letter, and access just as if it was a permanently installed internal unit.

Rounding out your on the road multimedia hardware is a source of sound. There are two ways to go with this, depending on your budget, what you want to accomplish, and whether or not you're planning on using a parallel port CD-ROM drive.

Let's look at the deluxe solution first. Obviously, with notebooks and most laptops, you don't have an empty expansion slot to drop in a sound card. This doesn't mean that you have to give up on great quality sound. Far from it, in fact! On the high-end of sound quality you can easily add a tone generator to your notebook. A tone generator is essentially a music synthesizer without an attached keyboard. Tone generators come in a variety of sizes, capabilities, and price ranges. One new one, targeted especially at the computer user who needs top quality sound, full MIDI instrument capabilities, and a reasonable cost is the CBX-T3 tone generator from Yamaha Corporation of America one of the major providers of the tone generator chips used in PC sound cards. Its OPL-3 chip is used in the top of the line cards from today's most popular vendors. Yamaha has a kinder, simpler name for the CBX-T3—Hello Music. Funny name aside, the CBX-T3 has some very significant differences from most sound cards. First off, it's an external unit which connects to a PC through a serial port with an included cable.

Good news for laptop and notebook users who don't have an expansion slot to drop a sound card into. Next off, unlike almost all sound cards, it doesn't have an on-board power amplifier. The output from this cigarbox sized synthesizer is meant to be routed to a stereo or pair of powered speakers. Not surprisingly, Yamaha

sells a complimentary pair of speakers for the unit as well as a MIDI keyboard controller.

And that's another big difference with Hello Music. While some other sound devices offer MIDI capability, the CBX-T3 is a MIDI synthesizer from the get-go. You interface it with the supplied, serial cable, install the Passport Designs TRAX software (which also installs the drivers Windows needs to use the CBX-T3 as the system's audio output device), and you're ready to go. Unlike most of the other sound cards you can buy, Hello Music doesn't come with loads of extra software. TRAX lets you play MIDI files through the CBX-T3, and since the unit is a full MIDI compatible device, the software also gives you a very nice sequencer (which is a software equivalent to a multitrack recording studio.) That, in fact, is one of the reasons for the optional MIDI keyboard controller, though any MIDI device can control or be controlled by the CBX-T3.

The Hello Music may be small. Vertically mounted, it takes up only a few inches of desk space. But for a small device, it carries a moderately hefty price tag—\$449, though like with many musical instruments (of which the CBX-T3 is one), street price is significantly less (as much as 50%, depending on the dealer.) The CBX-T3 is also in a different class when it comes to capabilities. Most soundboards give you 20 or so voices. The Hello Music has 192 different instrument voices, 10 complete drum sets, and digital reverb to boot. These voices are digital samples, which the sound card industry has taken to calling wave tables, rather than the less realistic FM synthesis. With the CBX-T3 you're getting much of the same technology that's contained in Yamaha's professional big buck keyboards in a small package and relatively small price.

We love the Hello Music box, but we do have one major criticism of it—the manuals. Both the Yamaha manual on the CBX-T3 and Passport Design's TRAX manual were written for musicians, rather than computer people, and they're abysmal. For example, nowhere in the CBX-T3 manual does it say that TRAX has to be installed before you can actually use the Hello Music with Windows. You can, and will figure out what's going on, but if Yamaha really wants to be a force in the computer sound area, rather than computer music market, they're going to have to redo these documents.

Even though it takes a bit of extra work, the excellent quality of both the equipment and resulting sound make the CBX-T3 Hello Music very much worth looking at.

Sound On The Run

But a tone generator like the Hello Music box and its companion powered speakers may be gross overkill in many situations. Sometimes all you really want and need is halfway decent sound at a modest volume level. You're not looking for concert hall realism, just a real improvement out of what you can get from the mousy little internal speaker in your PC (or you may have a notebook that lacks even that tiny little speaker).

In that case, DSP Solutions may just have the perfect solution for you with its \$198.95 (list price) PORT-ABLE Sound Plus. The PORT-ABLE Sound Plus consists of an Ad Lib and Sound Blaster compatible sound card contained in two small external units. One unit plugs into the parallel port of a PC or notebook, the other unit, essentially just a speaker, plugs into the first so that you get enhanced stereo sound. You can use only the single unit that's plugged into the parallel port (which, incidentally, has



One of the newest upgrade kits is the Sound Galaxy Pro 16 from Aztech Labs, Inc., a Level 1 upgrade kit with a list price of \$639.

a pass-through port so that you can also continue to use the printer). The main unit has connectors for an included AC power supply (or you can operate it on AA cells, as well as microphone and stereo audio inputs and stereo line out and headphone outputs. The PSP boosts sampling rates from 4KHz to 44.1KHz, on a par with a good quality internal unit.

PORT-ABLE Sound Plus doesn't come with a lot of different software. It has drivers that let it be used with DOS and Windows, LOTUS Sound which is an OLE application that lets you embed sound files within Window applications, and WinReader and DOSTalk and DOSReader programs which let the unit "read" from ASCII files. It also comes with an abridged version of DSP's Show & Tell for Kids, a very cute low-end package that lets you throw together a set of graphics pages and sound files. It most certainly is appropriate for kid. But it will also let you do a quick and dirty multimedia presentation easier than just about any other product we've seen. It won't be as sophisticated as a presentation prepared with Action or COMPEL, but it will go

together awfully fast.

In this life, if you're lucky, you get what you pay for. PORT-ABLE Sound Plus doesn't cost an awful lot, and it doesn't have some of the fancier features that you may expect from a soundboard. For example, most sound cards these days offer 20 or more instrument voices. The PORT-ABLE Sound Plus gives you either nine instrument voices, or seven instrument and four percussion voices. On paper this doesn't sound like much. In person it sounds just fine. And that's the bottom line. The PORT-ABLE Sound Plus gives your notebook a really nice sound. If it isn't loud enough, you can always plug a set of amplified speakers into the line out jacks, but most of the time you won't have to. About the only problem you might encounter is using the PSP along with another parallel port peripheral, like the Micro Solutions backpac CD-ROM drive discussed earlier. You can work this out, though. Just switch to MS-DOS 6.0, which lets you boot up choosing different CONFIG.SYS and AUTOEXE.BAT setups, and use only one or the other device during a particular session.

6 TIPS FOR GREAT PRESENTATIONS

1] MAKE SURE YOUR PRESENTATION IS APPROPRIATE FOR THE TIME YOU HAVE.

You can't explain the Theory of Relativity in detail to a class of third graders in 15 minutes. It doesn't matter how good a set of presentation tools you have at your disposal, it just can't be done. There's too much information that has to be presented, each bit building upon the information that comes before. You have to pace your presentation so that it builds to the conclusion you wish your audience to reach. If you try to present too much information, your audience will quickly overload. Too little information, and they'll go to sleep. Finding the balance is hard, but it's usually possible if you really know your audience.

2] BE PREPARED.

Creating a presentation, regardless of whether it's a simple set of overheads or a complex animated show complete with a musical score and digital video, is a lot of work. To make this work pay off, invest the time up front. Know who your audience is, what you want to put across, and the best way to make the impression you desire. Realize, though, that unless you're creating a stand-alone running presentation, most other presentations are meant to back up the points that you're trying to make, not replace you.

3] FOCUS ATTENTION.

One of the big secrets of making successful presentations, regardless of how fancy you get, is being able to shift the audience's focus and attention. If you allow the audience to focus on one thing too long, they'll start to lose attention. This is how hypnotists work, by focusing attention on an object or the sound of their voice to the exclusion of other stimuli. You don't want to hypnotize your audience, you want to involve them.

The easiest way to shift attention is MOVEMENT. Movement attracts attention. Step away from the podium if you're using one. Or point to the screen to emphasize a point. Look into the eyes of the individuals that make up your audience, and take to them. They'll respond. Multimedia is especially effective in focusing attention. Shifting musical tempo, inserting a short animated segment, or just throwing in a very brightly colored slide are all effective attention getters.

4] EMPHASIZE, BUT DON'T GO OVERBOARD.

There's one thing to keep in mind when you start creating your multimedia extravaganzas. It's really easy to get carried away. Sometimes to the point where your presentation is so elaborate that viewers get so caught up in the mechanics of what they see and hear, that they don't pay any attention to the information you're trying to present.

Yes, you want to grab your audiences' attention. But then you want to focus and direct it to the points you're trying to make. If this goal is foremost in your mind, chances are your presentations won't be so overblown they lose direction and effect.

5] WHEN YOU'RE FINISHED, END IT.

The most frequent mistake presenters make, both in personally given presentations and presented on and by computer, is to come to a definitive end when the presentation is finished. The point of any presentation, regardless of the medium used, is to make a point with your audience. If it's been successful in this, fine. Say thank you to the audience for their time, and good-bye. If it hasn't accomplished your goal, thank your audience and say good-bye. If a well prepared presentation hasn't gotten your point across, putting on for another 15 minutes certainly won't. Even worse is when you have made your point successfully, then blow it by going on and on. Say what you have to say, then say thanks and good-bye.

6] THE TIME TO WORRY ABOUT YOUR PRESENTATION IS BEFORE YOU GIVE IT, NOT DURING OR AFTER.

Computer hardware and software are great tools for enhancing presentations. But they're no substitute for preparation. Yes, you can throw together an impressive multimedia presentation in an hour or two if you have to. But if it's impressive with an hour or two's worth of work and effort, think how much more impressive and effective it will be with a reasonable amount of preparation.

It never hurts to have a bit of pizzazz. But it also doesn't hurt to know exactly what points you want to make, how to make them effectively, and how to build on what has been presented previously. Don't mistake flash for flair. In the end, if your presentation doesn't say what you want it to, you've wasted both your and your audience's time.

Software Is The Other Half

Setting up your hardware platform for multimedia is important, but it's just half the job. And to a large extent, the lesser in importance. The software that you use to create your presentation is the other half. And the particular packages that you choose and use, and the degree to which you can apply their features, will determine the overall success that your multimedia presentation will achieve. Chances are good that you'll probably start with one of the packages that accompany your hardware packages (if, indeed, you receive an authoring package with your hardware). Chances are also good that at some point you'll try one or more other packages. When you've been doing multimedia for a while, it's very likely that you'll have a set of programs that you use.

Before you can select a product to use in developing a presentation, there are a number of decisions that you'll have to make about the direction that the presentation will take. The first of these is whether your presentation is actually a multimedia presentation, or a standard slide presentation with some multimedia clips added. There's a difference. Most standard presentation graphics packages, including Freelance Graphics for Windows, Harvard Graphics for Windows, Microsoft PowerPoint, and Word Perfect Presentations, allow you to embed objects within a presentation. These objects can include (but are not limited to) graphics created by other software packages, scanned in, or captured with a frame grabber, music clips (usually in .WAV format), and sampled audio (voice or music), again most frequently in RAM-hogging .WAV form.

On the other hand, a true multimedia authoring system takes a somewhat different approach. While it

probably has slide creation and display capabilities similar to those presentation graphics packages mentioned above, it also will contain facilities for creating different parts of a multimedia presentation, such as animation, digital video, and a musical score, and a facility for assembling these into a coherent whole.

One of the packages we use frequently is Compel from Asymetrix. Compel incorporates an earlier product, MediaBlitz!, and between the two, provides a full range of presentation and multimedia authoring tools for a \$295 list price. Mail order pricing has been running a bit over \$200, and Compel is being increasingly bundled with multimedia hardware, so it's very possible that you could wind up with a copy when you make a hardware purchase.

Even discounting the multimedia aspects, Compel is a great value just as a presentation graphic package. It comes with a CD-ROM of sound, animation, and clip art clips, installs from the CD-ROM (as does MediaBlitz!) and supports the new Kodak Photo CD standard as well. As with most products of this ilk, you select a master style from among the over 100 templates included, choose a page style, such as Title, Graph, Bulleted List, etc., and start entering text or placing graphics, clip art, music, voice, or video. Compel supports all media types for embedding, and you can create hyperlinks which bring in other slides, or launch a media object. Compel lets you easily autobuild a series of slides. You create a bulleted list, and by giving the AUTOBUILD command, you create a progression of slides that adds a bullet with each additional slide. There are also a number of bullet effects available, such as dimming and highlighting.

Compel also allows you to create portable presentations with its

runtime Show software, that lets the presentation be shown on PCs that don't have the Compel package. You can also package the presentation and send the complete runtime presentation to another user through electronic mail.

MediaBlitz!, which is currently being packaged with Compel, is a multimedia "arranger". It lets you create visual scores, comprised of graphics, AutoDesl Animator files, Digital video, and clip art. Music and sound scored are created by defining sources, and can include .WAV files, .MID (MIDI) files, recorded sound including voice, and CD audio. When you've assembled all of your score components, they get pasted down against a timeline, by either using a menu driven process or by dragging and dropping them onto the timeline. Adjustments are made the same way, either by fiddling with menus, or just dragging the media "object" where you want it. The CD-ROM that accompanies the product has lots of clip art, clip sounds, and even short animated clips.

The combination of Compel and MediaBlitz! isn't perfect. For one thing, Compel lacks an outliner, which can make planning a complex presentation more of a chore than it has to be. But all things considered, if you're starting out on the multimedia path, the combination is a very attractive one, and the price is great! ■

Companies Mentioned

Asymetrix 110-110th Ave. N.E., Suite 700, Bellevue, WA 98004; (800) 448-6543

Aztech Labs, Inc. 46707 Fremont Blvd., Fremont, CA 94538; (510) 623-8988

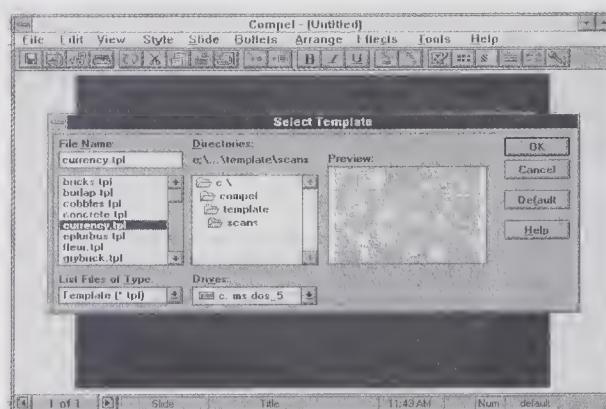
Micro Solutions Computer Products 132 W. Lincoln Hwy., DeKalb, IL 60115; (815) 756-3411

Yamaha Corporation of America P.O. Box 6600, Buena Park, CA 90622; (714) 522-9011

12 EASY STEPS TO YOUR FIRST PRESENTATION

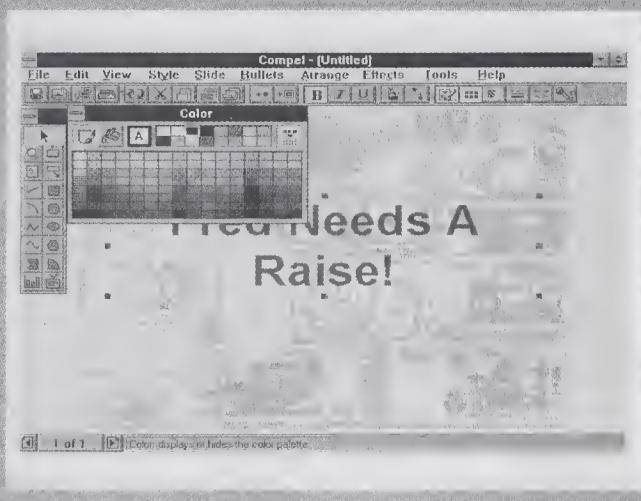


SLIDE 1:

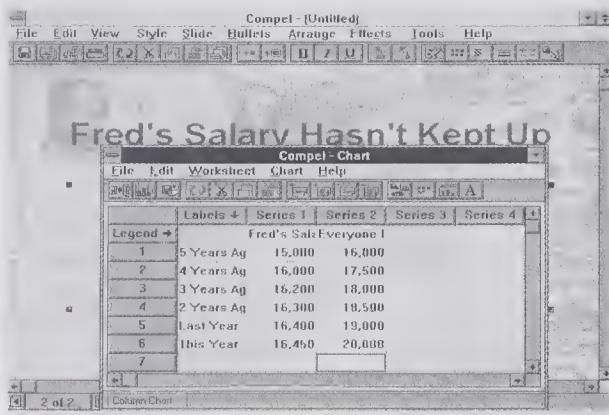


SLIDE 2:

STEP 2: Once you've chosen your background, you'll be presented with the first slide. This slide is in TITLE format, and contains an area for you to type your title. We've typed "Fred Needs A Raise!" and clicked on the little color panel icon in the tool bar to change the text color.



SLIDE 3:

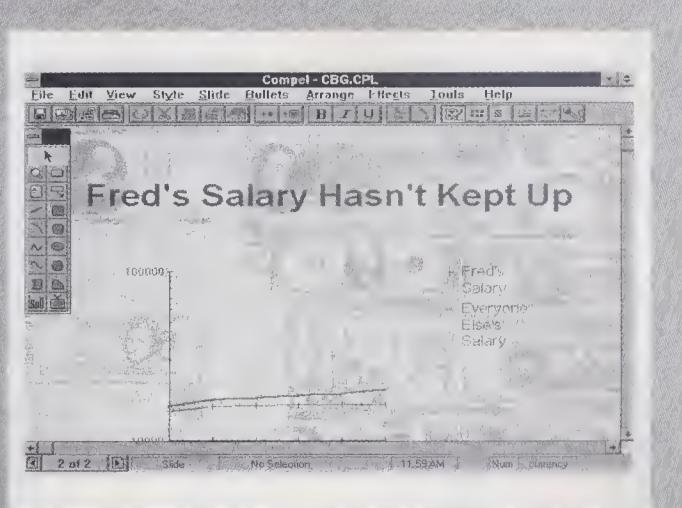


STEP 1: The first thing you need to decide is which template set you'll use for your presentation. The default is nice, but because our presentation was a push for a raise for Fred, we wanted it to have a money background. By clicking on the SLIDE selection, then on CHANGE TEMPLATE, you are presented with numerous templates you can choose from. The Preview box changes as you move the highlight bar from choice to choice. To make a selection, just double click.

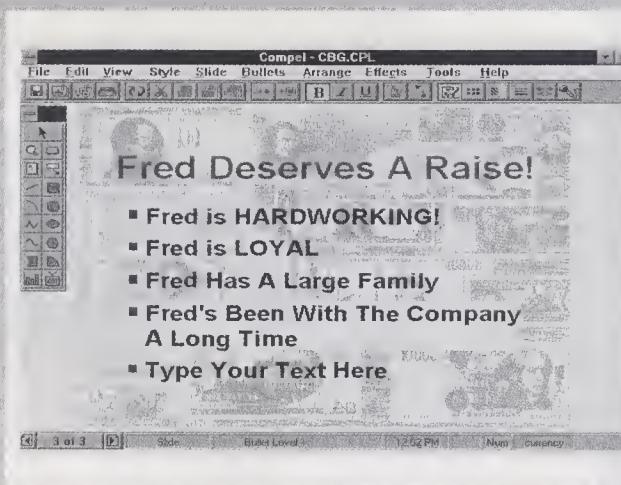
STEP 3: One way to punch up Fred's request is to show graphically how his salary hasn't kept up. Click on the SLIDE command on the horizontal menu, then ADD to add another slide. You'll be given a choice of slide types and will choose CHART. The mini-spreadsheet shown is used to enter the information we want to appear in the chart. Then click on the chart type icon (second from left) to choose line chart.

SLIDE 4:

STEP 4: Compel automatically selects a line type and color combination for you. We decided to spice up our chart with red and blue primary colors. This takes just a few seconds and several clicks on the OPTIONS choice screen.



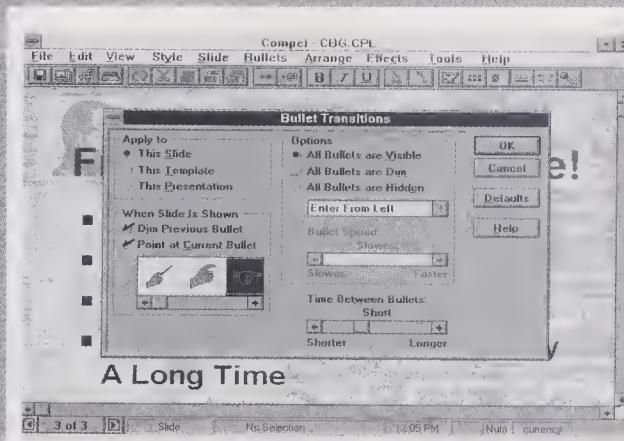
SLIDE 5:



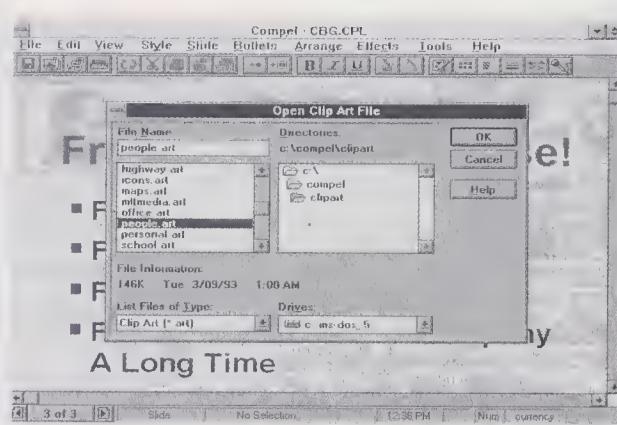
STEP 5: Our next slide is a bulleted list. Again, select ADD from the SLIDE menu, and specify BULLETED LIST as the slide type. Then just type in the slide's title and the bullet points. You can easily change the font, point size, and bullet appearance.

SLIDE 6:

STEP 6: There are also a number of very effective special effects you can add to really punch up your presentations. AUTO-BUILD takes each major bullet point and creates a new slide for it. The screen shown here is for Bullet Transitions. We've selected a pointer which, as it travels down the list of bullet points, automatically highlights the point. The remainder of the points are dimmed out.



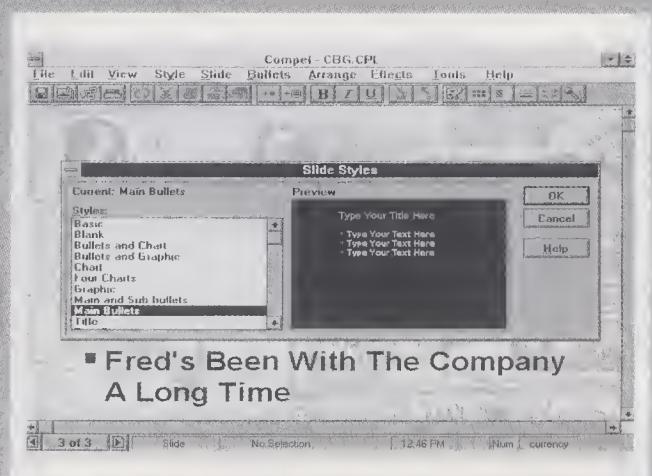
SLIDE 7:



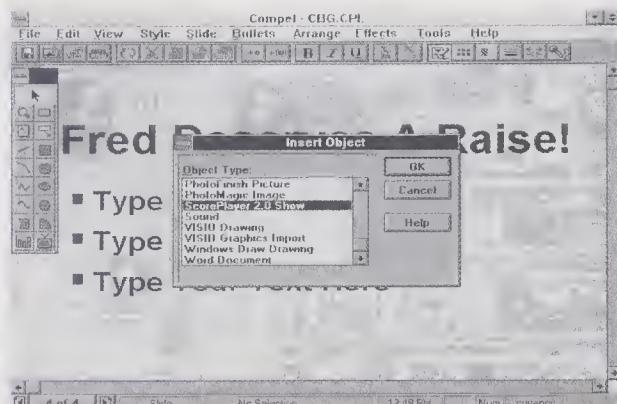
STEP 7: Adding clips also punches up your presentation. You can access Compel's clip art file by clicking on the second icon from the left on the horizontal tool bar. Compel comes with a large number of clip art images on CD-ROM. You can also use most other clip art formats.

SLIDE 8:

STEP 8: If you need a new slide, just select SLIDE, ADD. The selection panel shown here will appear. You can also change an existing slide to a new format, or even use a different template within your presentation.



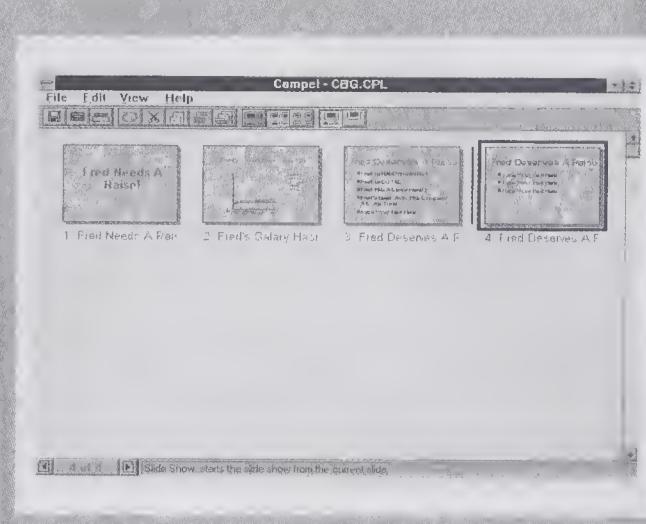
SLIDE 9:



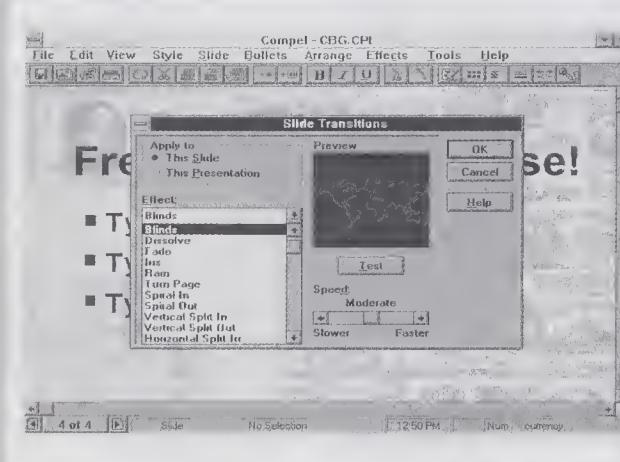
STEP 9: If we really want to pour it on, we could get an audio clip of some real syrupy music (maybe Hearts and Flowers), and have it play during the presentation. It's pretty easy to do. Just select INSERT OBJECT under the EDIT menu, and specify the OBJECT TYPE and its location. We could get even fancier by tying the music to a button or other object created with the drawing tools at the left of the screen.

SLIDE 10:

STEP 10: When you think you're finished, click on the slide sorter icon (the third icon from the left.) This lets you see thumbnails of your slides and the way they are ordered. If you want to change the order of the presentation, just drag and drop the thumbnails to where you want them to appear.



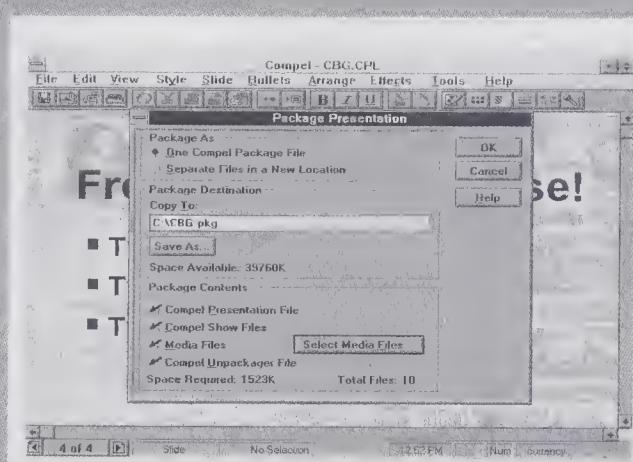
SLIDE 11:



STEP 11: You can also add transitional effects between slides. There are lots of effects, and the preview window lets you see what the effect does before you actually apply it. You don't need to apply the same transition to every slide. In fact, each slide can have a different effect, or no effect at all.

SLIDE 12:

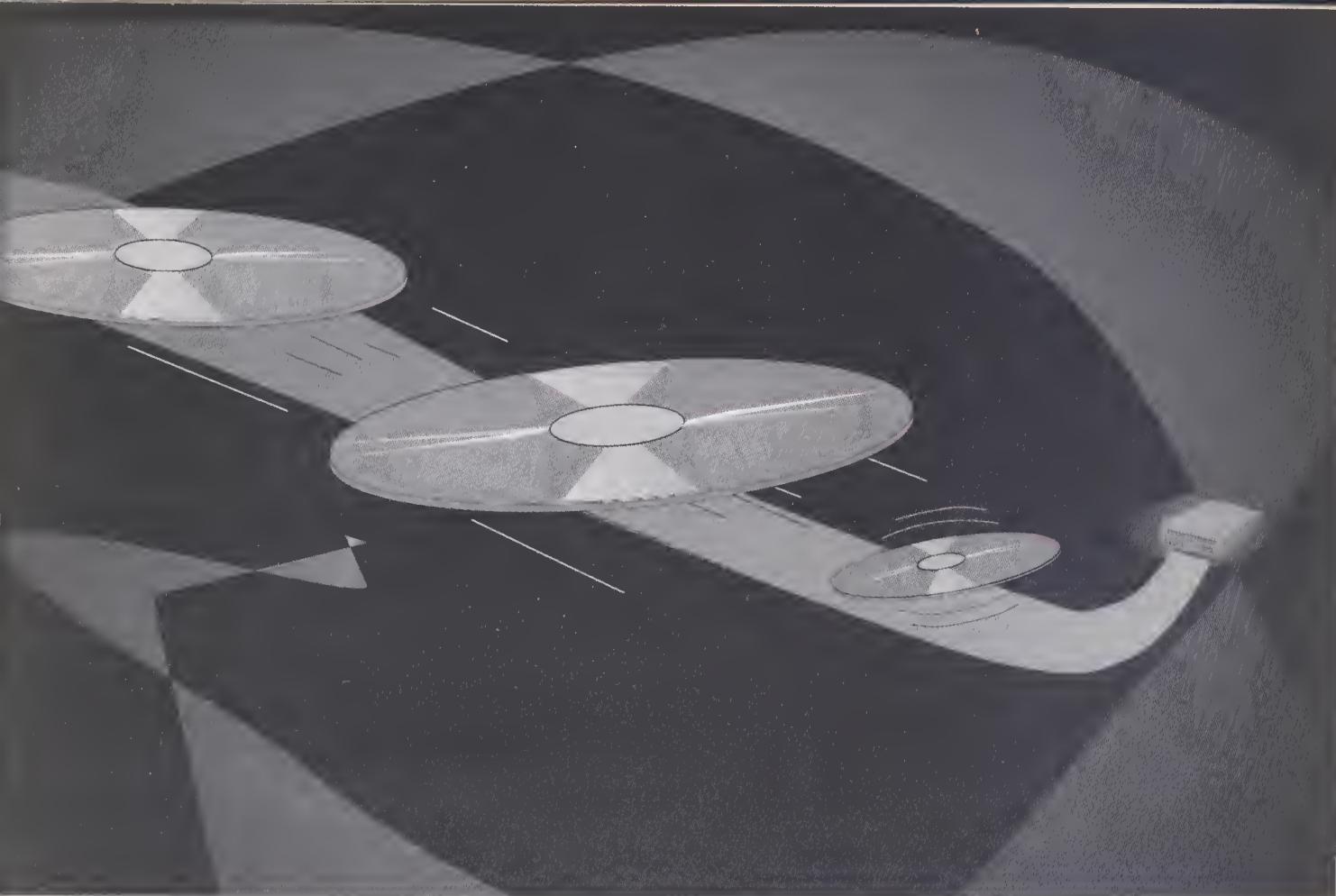
STEP 12: When you're satisfied with the way the presentation appears and flows, the final step is to package it so that it can be played on a PC that does not contain Compel. Congratulations on your first Compel presentation. (And, by the way, Fred got his raise!)





CDs — The New Technology Highway

Once you've upgraded to a new CD-ROM Reader, it's time to go holiday disc shopping! Experience the adventure and fun of all the exciting and educational programs available on today's hottest medium!



It seems, finally, that hardware manufacturers are producing reasonably priced CD-ROM readers, developers are creating attractive, useful CD-ROM titles, and consumers are buying enough readers and titles to create the kind of downward price movement prevalent in the rest of the computer world.

A look at the number of available CD-ROM titles alone shows how quickly the industry is growing. There are now about 4,350 CD-ROM titles in print, up from 3,200 last year and 2,200 in 1991, according to InfoTech, a market research firm based in Woodstock, Vermont. InfoTech projects that this explosive growth will continue, reaching 7,200 titles in 1995.

Recognizing the importance of CD-ROM, many computer manufacturers are now bundling CD-ROM readers with their systems or offering them as low-cost options. Gateway

2000 includes an internal CD-ROM drive with some of its 486 systems and offers a complete multimedia upgrade kit for its systems, including a CD-ROM drive, a 16-bit sound card, and external speakers, for \$395. Zeos sells an internal CD-ROM drive for \$199, and it'll swap out a 5-1/4 inch floppy drive for a CD-ROM drive in one of its systems for just \$99. You can also buy third-party CD-ROM readers for as little as \$200. It wasn't long ago that you needed to plunk down a whopping \$1,000 to buy a CD-ROM drive.

If you're going to be running multimedia CD-ROMs that include sound, animation, or video, it's best to avoid the very low end, particularly if you're the impatient type. Higher-end "double-speed" CD-ROM readers, which are also about double in price, will make using your CD-ROMs much more enjoyable. The Multimedia Marketing Council has

now declared these newer CD ROM readers as part of their MPC II standards, replacing the slower readers in the MPC I minimum system requirements.

Recognizing the benefits, many software developers are beginning to distribute their conventional software programs on CD-ROM. For one thing, this makes it possible to include more capabilities than with software distributed only on floppies. It also makes the software easier to install—you stick in one CD-ROM instead of having to do the floppy shuffle with 10 or 15 disks. Corel Draw 4.0, for instance, includes an additional 16,000 pieces of clip art and 700 fonts, in both True Type and Type 1 formats, on two CD-ROMs.

These numbers, like many things involving CD-ROM, bring to mind one word: staggering. For one thing, a single CD-ROM disc can hold a staggering amount of data. Thinner

than a book cover and measuring just 4.75 inches across with a 0.6-inch hole in the center, CD-ROMs typically hold about 650 Mb of data. This is the equivalent of 1,800 360-KB floppy disks, 600,000 typewritten pages, or 500 full-length novels. CD-ROMs that use compression techniques can pack in even more.

Computer CD-ROM technology sprang from the same roots as audio CD technology, and CD-ROM discs look much like audio CD discs. Made primarily of reflective aluminum, the material used in bulletproof glass, a CD-ROM disc is etched with a single, amazingly thin, spiral track that's a staggering 3 miles long. This track can hold not only music and other sound, but also text and still images and animation and video, making it today's best medium for multimedia.

There's also—and this may surprise some—a staggering number of types of CD-ROM titles available. *CD-ROMs in Print 1993*, the most comprehensive listing of CD-ROM titles on the market, lists 168 separate categories, from "Advertising and Consumer Information" to "Zoology." Most CD-ROM titles are targeted to vertical markets, such as the advertising industry or the field of engineering. But there are more and more general-interest titles available as well.

Most CD-ROM titles are DOS- or Windows-based. However, of the 3,500 titles listed by *CD-ROMs in Print 1993*, you can use about 700 with a Macintosh. (*CD-ROMs in Print 1993* comes in both a CD-ROM and a paperback version. The cost is \$95 for either. You can contact Meckler Publishing. See below for address.

Incidentally, the preferred term among insiders is "CD-ROM title," not "CD-ROM program" or "CD-ROM software," since with CD-ROMs the emphasis is on the content, not the computer code. Often "CD-ROM

title" is abbreviated as simply "CD-ROM." Also, the term "CD-ROM reader" is preferred over "CD-ROM drive," since CD-ROM readers can only read from discs, unlike hard and floppy drives, which can both read from disks and write to them. To add to the confusion, sometimes "CD-ROM disc" is used—perhaps to show solidarity with audio CD discs—and other times you see "CD-ROM disk."

Along with CD-ROM readers, CD-ROM titles are also coming down in price. Typical prices range from \$20 to \$500, but they can go considerably higher for specialized, vertical market titles. If you're not sure you want to spend this kind of money, you may be able to rent the CD-ROM title you're interested in.

Renting CD-ROMs

Video stores are beginning to rent CD-ROM titles along with movies. Because their read-only nature makes it more difficult to pirate CD-ROM titles, renting CD-ROMs doesn't pose the same risks as renting traditional floppy-disk-based software. The cost for renting CD-ROMs is generally about \$3 per disc per day.

Compton's NewMedia, a developer of CD-ROM titles, expects that by the end of 1993 more than 100 video stores across the country will be renting over 50 of its titles and those of its affiliates. These titles include *Jazz: A Multimedia History*, *KGB/CIA World Factbook*, *U.S.A. Wars: Operation Desert Storm*, and *Beauty and the Beast*. "Our goal is to make CD-ROM software as ubiquitous as videos in today's society," says Norman Bastin, Compton's senior vice president and general manager.

You can also rent CD-ROM titles through the mail. Wedgewood Rental, for instance, offers hundreds of titles for rent at \$5 to \$38 per week. You have to pay a refundable deposit for

each title. After the rental period is up, you can elect to buy the title, in which case you'll get back both your deposit and your rental fee. (If you don't buy the title, you forfeit the rental fee but not the deposit.) For each order, there's a \$4 shipping and handling charge. If you don't want to pay a rental fee, check your public library. Many are now starting to lend CD-ROM titles.

One of the complaints about using CD-ROMs has been their slowness, which at first, seemed to have been officially sanctioned. Perhaps in the hopes that if compliance was at a low enough level it would attract more manufacturers. Obviously that has changed with the new MPC II standards. Originally, to wear the Multimedia PC (MPC) Marketing Council logo, a CD-ROM drive merely had to have an average access time of 1 second (1000 ms) or less and a minimum sustained transfer rate of 150 K/sec. This minimal speed, however, is too slow for most applications and users.

Acceptably fast CD-ROM drives have average access times of 350 ms and sequential transfer rates of 150 K/sec. Some higher-end CD-ROM readers use double-speed technology to go even faster. Toshiba America's XM-3401 internal CD-ROM drive, for instance, which lists for \$695, boasts an access time of 200 ms and a transfer rate of 330 K/sec, making it one of the fastest CD-ROM drives on the market.

Disk caches that support CD-ROM readers can also improve speed considerably. In the past disk caches generally supported only hard and floppy disks. See below for programs that support disk caches for CD-ROMs.

Another complaint people have had was that some CD-ROM titles were little more than massive collections of text. In some cases, a text-only

approach makes sense, such as with ProCD's ProPhone, a seven CD-ROM disc set that includes the majority of telephone numbers from every city in

the country, plus the mailing addresses of most businesses. ProPhone lists for \$295.

On the other hand, encyclopedias,

educational titles, and games should take advantage of the multimedia capabilities CD-ROM — sound, animation, and video.

The following are some of the top CD-ROM titles today:

ENCYCLOPEDIAS

Perhaps the one type of work that's best suited to take advantage of CD-ROM technology is encyclopedias.

CD-ROM based encyclopedias have many advantages over their hard-cover brethren. First, they're less expensive — hardcover encyclopedias generally cost from about \$700 to \$1,400. Second, they take up lots less space than the 20+ volumes of a hardcover encyclopedia. Third, they're more environmentally friendly — lots of trees go into making new encyclopedias, and old encyclopedias usually wind up in landfills. Fourth, the best ones include not only text and

pictures, but also sound bites, instructional animation, and video sequences. An otherwise dry subject can really come alive when you can see it in action and hear about it as well.

Perhaps most important, using a CD-ROM encyclopedia can be considerably faster than looking through a 29-volume hardcover encyclopedia. You can usually just type in the name of the subject you want information about, and the program presents you with a list of the articles in which the subject is mentioned. You often can broaden or narrow your

search by using AND, OR, and NOT Boolean operators or by using the * and ? wildcards.

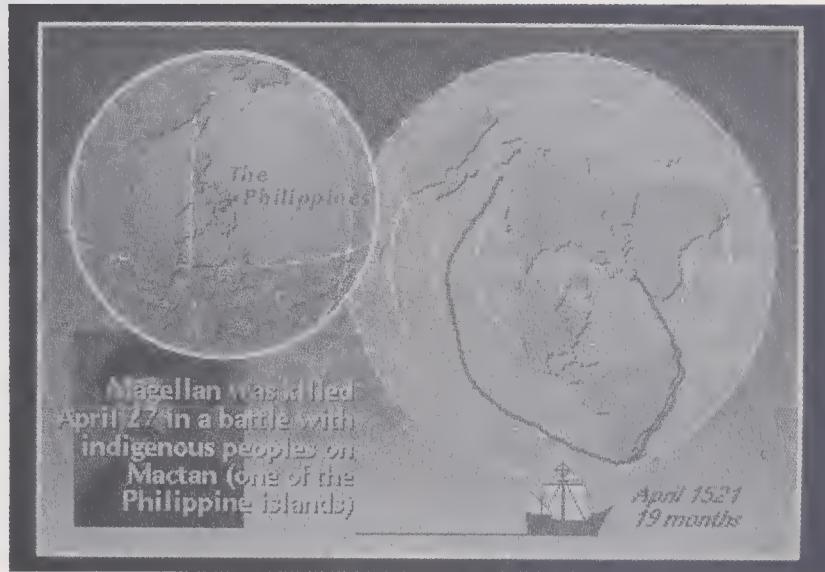
What's more, you can generally move quickly to a related article that's cross-referenced to the article you're currently reading by simply double clicking on a word.

With Windows- or Mac-based encyclopedias, you can copy and paste a quote or passage from the encyclopedia into your word processor document. (But don't use long segments verbatim — this may result in copyright infringement or even plagiarism.)

New Grolier Multimedia Encyclopedia

This is the most comprehensive general-interest CD-ROM encyclopedia available today. On a single CD-ROM disc, it includes all the text in the 21 volumes of the hardback Grolier's Academic American Encyclopedia. You'll find 33,000 separate articles and 10 million words, more than in any other CD-ROM encyclopedia. However, unlike Compton's Interactive Encyclopedia or Microsoft Encarta Multimedia Encyclopedia — its main competition — no dictionary or thesaurus is included.

You also won't find all the pictures that are in the hardback version, but the CD-ROM version does include more than 3,000 color and black-and-



white images, from Michelangelo's David to Alaska's Columbia glacier. What's more — and you won't find this in any hardcover encyclopedia — there are nearly 150 video and animation sequences and excerpts of 21 famous speeches. With some of the speeches, but not all, you view the speaker as you hear the speech.

The multimedia capabilities of Grolier aren't as flashy as those in Encarta, but they're first rate. You can view, for instance, footage of Neil A. Armstrong's first step on the moon. You can hear the best part of Martin Luther King's "I Have a

Dream" speech. And you can both view and hear Richard Nixon's farewell speech when he resigned from the presidency. By TV standards, the video is small and sometimes jerky, but you still get the picture.

You can have great fun browsing the encyclopedia. But when you need to get down to work and research a subject, you'll find the search facility to be friendly and sophisticated. You click on the magnifying glass icon, and you can, among other things, search for words using AND or NOT Boolean operators in article text, article titles, captions, or all three.

Searching with Grolier, and moving around in general, is faster than it is with either Compton's or Encarta.

New Grolier Multimedia Encyclopedia is available in DOS, Windows, and Macintosh versions.

Price: \$395.

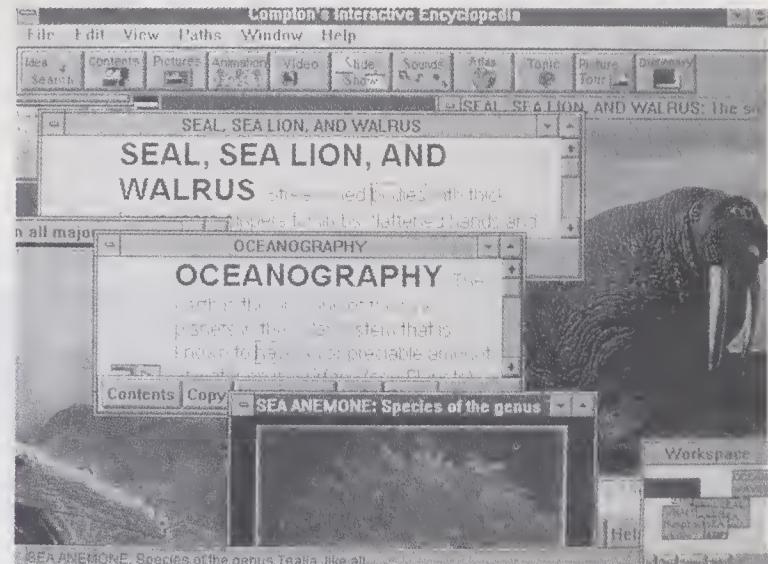
Company: Grolier Electronic Publishing, Sherman Turnpike, Danbury, CT 06816, (800) 356-5590, (203) 797-3530.

Compton's Interactive Encyclopedia

Of the three top CD-ROM encyclopedias — Grolier, Compton's, and Encarta — Compton's Interactive Encyclopedia is the best one for kids. Its writing style and vocabulary are designed for children ages 8 to 15, and, unlike Grolier, the icons are all labeled.

Yet Compton's is no slouch when it comes to depth. It includes the full text of the entire 26-volume Compton's Encyclopedia, 32,000 articles and 9 million words in all. Unlike Grolier, it also includes all the pictures found in the hardcover version, 15,000 in all. Compton's also includes the complete Merriam-Webster OnLine Dictionary and Thesaurus — 70,000 words in the dictionary and 100,000 in the thesaurus.

The multimedia capabilities of Compton's are impressive. Click on the video's icon, and you can view video clips ranging from bacteria in motion and Civil Rights movement to Jupiter and Babe Ruth. The Babe Ruth clip, for instance, shows the



Sultan of Swat hitting one of his home runs, while a narrator takes about 15 seconds to describe him and his baseball accomplishments.

Click on the animation icon, and you can view educational color cartoons. One of the more graphic cartoons first labels the digestive sys-

tem, then shows how the stomach empties itself. Fortunately, it's all in good taste. There are also still pictures of a Boeing 747, slide shows illustrating aspects of the life of Christopher Columbus, and sound sequences of Bizet's "Carmen."

Compton's Interactive Encyclope-

dia doesn't provide any Boolean search tools. But for any of video clips, animation, still pictures, slide shows, and sounds, you can use hypertext links to go directly to the encyclopedia article associated with it. Unfortunately, this isn't the speediest

procedure — unless you have a very fast CD-ROM reader, you may find yourself tapping your fingers waiting for the text to appear.

Compton's Interactive Encyclopedia comes in Windows, DOS, and Macintosh versions.

Price: \$395.

Company: Compton's New Media, 2320 Camino Vida Roble, Carlsbad, CA 92009, (800) 862-2206, (619) 929-2500.

Microsoft Encarta Multimedia Encyclopedia

Unlike Grolier and Compton's, this is a Windows only product, though Microsoft says a Mac version is in the works. Microsoft Encarta Multimedia Encyclopedia is the most visually impressive of the three packages, showing off dazzling multimedia effects. But it's also the slowest.

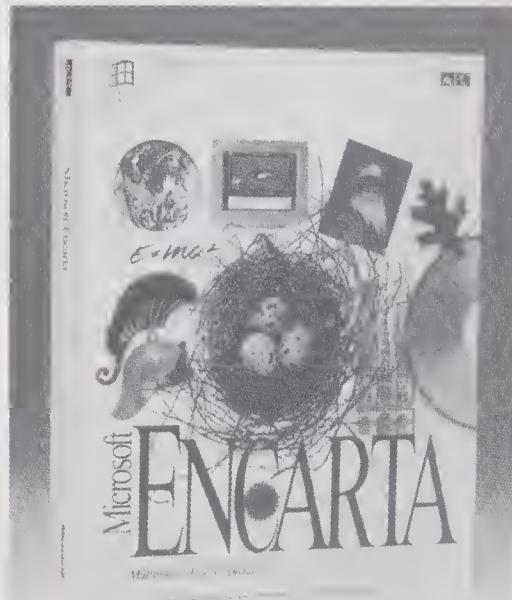
Encarta includes the complete text of the 29-volume 1992 Funk & Wagnall's New Encyclopedia and more than nine million words in 25,000 articles. Microsoft supplemented the content taken from the hardcover encyclopedia with 1,000 new articles and 15,000 multimedia elements, including over seven hours of sound (more than Grolier and Compton's put together). Also included is an 83,000-word dictionary based on Webster's Electronic Dictionary, Concise Edition and a 40,000-word thesaurus based on Webster's Collegiate Thesaurus.

Encarta's lack of speed is largely due to its multimedia richness. The seven hours of included sound consist of more than 1,000 music segments, 272 bird and animal sounds, 155 literature readings by authors such as T.S. Eliot and e.e. cummings, 1,500 word pronunciations, and 900 samples of words and

phrases in languages ranging from American Navajo to Swahili. There are also 45 videos, nearly 100 educational animations, 7,500 mostly color photos, 2,000 illustrations, 1,000 maps, and 290 charts.

Microsoft manages to pack all this onto one CD-ROM using various compression techniques. Unfortunately, it may have overdone it. The going is slow, from loading the program to moving from one section to another.

To improve responsiveness, Microsoft suggests you do a full instal-



lation, which loads more than 5MB of support files onto your hard disk. It also suggests closing all applications you're not using, setting up a permanent Windows swap file, defragmenting your hard disk, and buying more RAM (the program requires at least 2MB but Microsoft recommends at least 4MB). Even with these steps, you definitely need a fast CD-ROM reader and a good CD-ROM disk cache to make Encarta usable.

For homework and other research, Encarta is adept at searching. It permits full Boolean searches using AND, OR, NOT, and NEAR operators, along with * wildcard searches.

There's also a clever Research Wizard feature — just answer some questions about your subject and the wizard gathers up all the available information in the encyclopedia.

Microsoft is offering a special \$99.00 introductory price on Encarta 94. This pricing will run through December 31, 1993.

Price: \$395.

Company: Microsoft Corp., One Microsoft Way, Redmond, WA 98052, (800) 426-9400, (206) 882-8080.

McGraw-Hill Science and Technical Reference Set

Unlike Grolier, Compton's, and Encarta, this CD-ROM encyclopedia is specialized — it focuses on science. It's actually a combination of two hardcover books — the McGraw-Hill Concise Encyclopedia of Science & Technology and the McGraw-Hill Concise Dictionary of Science and Technical Terms.

The encyclopedia includes 7,700 articles written by, among others, 19 Nobel laureates. Also included are 1,700 graphic elements such as photos, line drawings, charts, tables, formulas, and chemical structures — all those found in the hardback version. The dictionary consists of more than 117,000 definitions.

McGraw-Hill Science and Technical Reference Set is a DOS-only product with mouse support, though you can use it if you're running Windows. McGraw-Hill is planning to release a

Windows version next year, but has no plans for a Mac version.

Don't expect the flashy multimedia effects you get with some other CD-ROM products. There are no videos, no animation, and no sound. What's more, unless you have expanded RAM or have set up your computer to use expanded RAM, you won't be able to view any of the included graphics.

Still, the scope and depth of the information are impressive. The McGraw-Hill Science and Technical Reference Set covers more than 75 areas of theoretical and applied science. Much of the information covered is technical, but not all. There's a listing, for instance, for ice cream in the dictionary. Dictionary is a bit of a misnomer, since even the dictionary listings are several paragraphs long.

Navigating around the program is much like moving around an outlining program. You use the up or down arrow keys to highlight a range of subjects, then press the right arrow key to expand this range. You continue expanding until you find the subject you want, then press the Enter key.

You can also use the search feature to find all references to a topic in all the articles and definitions, though this takes more time. The program also includes hypertext links — you can quickly jump to a related topic by moving the cursor to a highlighted topic in the article you're currently reading and pressing the Enter key.

Price: \$495

Company: McGraw-Hill, 11 West 19th St., New York, NY 10011, (800) 262-4729, (212) 512-2000.

OTHER REFERENCE

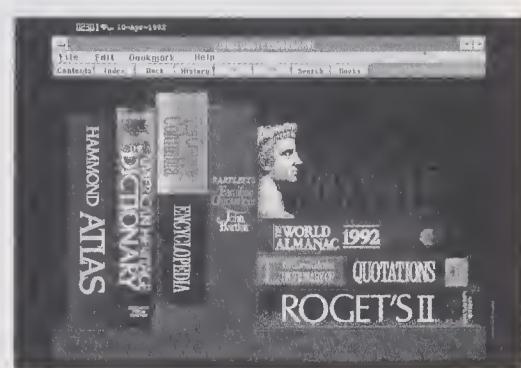
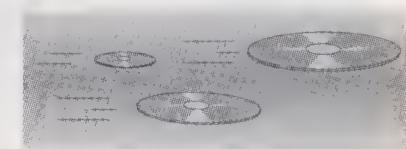
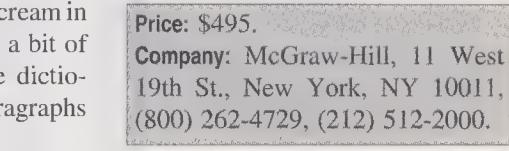
In addition to encyclopedias, there are a slew of other reference materials available on CD-ROM. The huge capacity of CD-ROM and the huge quantities of text and other materials in reference works are a natural match.

Microsoft Bookshelf, 1993 Edition

If you're running Windows, and you buy just one CD-ROM reference work, this should be it. Microsoft Bookshelf is a popular title that combines seven different electronic reference works: Concise Columbia Encyclopedia, Bartlett's Familiar Quotations, World Almanac and Book of Facts 1993, Concise Columbia Dictionary of Quotations, Hammond Atlas of the World, American Heri-

tage Dictionary, and Roget's II: The New Thesaurus.

Microsoft Bookshelf isn't as flashy as Microsoft Encarta, but it packs plenty of multimedia punch. The dictionary includes more than 65,000 spoken pronunciations. The encyclopedia uses 50 animations



to illustrate concepts such as photosynthesis. Barlett's Quotations includes 40 audio clips allowing you to hear John F. Kennedy, Robert Frost, and others speak. Among the musical examples are the national anthems of more than 160 countries.

Microsoft Bookshelf is also a powerful reference tool. By clicking on

the find icon, you can search for all the references to a particular word in any or all seven of the included works. To narrow or expand your search, you can optionally use AND, OR, NOT, or NEAR Boolean operators and the * wildcard.

Like Encarta, though, Bookshelf isn't the speediest CD-ROM out there.

But with a fast CD-ROM reader, it's an attractive and valuable reference tool.

Price: \$195.

Company: Microsoft Corp., One Microsoft Way, Redmond, WA 98052-6399, (800) 426-9400, (206) 882-8080.

Reference Library

This title, from the Software Toolworks, is the DOS equivalent of Microsoft Bookshelf. On one CD-ROM disc it includes eight different reference works. There's the New York Public Library Desk Reference, the Dictionary of 20th Century History, J.K. Lasser's Legal and Corporation Forms for the Smaller Business, and a National Directory of Addresses and Telephone Numbers.

Webster is well represented. Included are Webster's New World Dictionary of Quotable Definitions, Webster's New World Guide to Concise Writing, Webster's New World Dictionary, and Webster's New

World Thesaurus.

Unlike Encarta, Reference Library is not flashy — there are no multimedia features, not even any graphics. But the program is a lot faster. Though it's DOS based, you can run it from Windows, and it supports a mouse. To navigate around the program, you select one of the reference works listed to the right of the screen. You can also search for subject matter using either the AND or OR Boolean operators.

Reference Library is a handy reference tool, and in the world of heavy, multimedia-laden CD-ROM titles, it's quick too.



Price: \$99.95.

Company: Software Toolworks, 60 Leveroni Ct., Novato, CA 94949, (800) 234-3088, (415) 883-3000.

Computer Select

If you ever need detailed information about computer products or the computer industry in general, Computer Select is one terrific, though expensive, tool.

Computer Select is a subscription CD-ROM based service. For an annual subscription price of \$995, you

receive a new CD-ROM disc in the mail each month. Each disc includes an updated collection of full-text articles and abstracts from 175 computer and other periodicals. Detailed specifications of 74,000 software and hardware products, and information on 13,000 computer product manu-

facturers are included.

The CD-ROMs include both DOS and Windows interfaces, but the content is entirely text based, which is no handicap. The search feature is sophisticated. You can quickly search for specific information by topic, product name, company name, type of

article, publication name, or author name, and you can use AND, OR, and NOT Boolean operators.

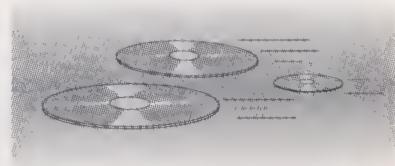
Computer Select is expensive, and if you plan to use it infrequently, it's cheaper to access it through Compu-

Serve. But if you frequently make computer-related buying decisions or recommendations, buying a subscription can be a smart move—great for micromanagers with corporate budgets.

Price: \$995 annual subscription
price includes 12 monthly updates.
Company: Ziff Communications
Co., One Park Ave., New York,
NY 10016, (800) 827-7889, (212)
503-4400.

EDUCATION

There are numerous CD-ROM titles available whose goal it is to teach. Some are geared toward children, some toward adults. The range of subject matter covered is nearly as broad as the field of human knowledge. The depth of individual titles is often staggering.



Library of the Future

This CD-ROM title is more aptly named Library of the Past — it includes the complete unabridged text of 971 of history's greatest literary works.

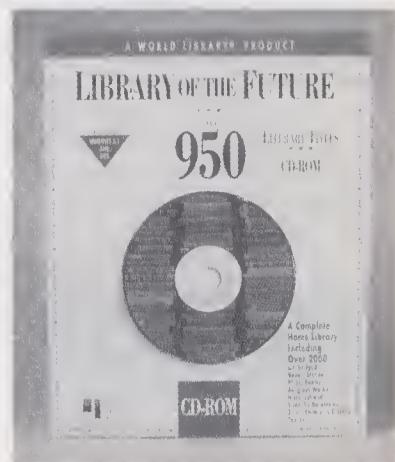
The scope of the material boggles the mind. Of religious works, it includes the full text of the King James Bible, the Koran, the Egyptian book of the Dead, and the Bhagavad Gita. Of political treatises, it includes the complete Magna Carta, the Declaration of Independence, the Federalist Papers, and the U.S. Constitution. Of literary works, it includes the complete works of Shakespeare, Sherlock Holmes, and Edgar Allan Poe, and the full text of Canterbury Tales, Milton's Paradise Lost, Hawthorne's Scarlet Letter, Emily Bronte's Wuthering Heights, Shelley's Frankenstein, Bram Stoker's Dracula, Dostoevsky's Brothers Karamazov, and hundreds more.

This wealth of wisdom is compressed onto one CD-ROM, which includes interfaces for both DOS and Windows. Surprisingly, loading and

using the program is fast. You won't find any multimedia flourishes, but the Windows interface is attractive and functional. By clicking on a button to the left of the screen, you can list all the works included on the CD-ROM along with their authors. By clicking on another button, you can list all the authors. Click on an author's name, and you're shown the masterpieces he or she has written that are included.

One way to use the program is to find the title you want and simply doubleclick on its name to bring the text to the screen. Then read it by scrolling down the screen instead of flipping pages. Some texts include black and white line drawings with them — to see these, you just click on a button at the top of the screen.

Another way to take advantage of the program is by using the sophisticated searching tools, which make this collection incredibly more useful than poking around a dusty library. You can search for any word or various combinations of words within a



single text, an author's collected works, a category of works such as religion or poetry, all the works in a given time period or from a particular country, or any combination of the above. For searching precision, you can optionally use the * or ? wildcards.

Price: \$299.
Company: World Library, 12914
Haster St., Garden Grove, CA
92640, (714) 748-7197, Fax: (714)
748-7198.

U.S. History

U.S. History is a DOS-based collection of historical texts that exemplifies how some CD-ROM titles fail to take advantage of the capabilities of CD-ROM technology. If there was ever a subject whose dryness could be made more palatable by sound, animation, or video, it's history. Unfortunately, U.S. History is little more than a collection of words and pictures.

U.S. History does include the full text of 107 books plus over 1,000 photos, illustrations, and tables. Some

of the historical material is quite interesting, including transcripts of the Nixon Watergate tapes and the Iran-Contra hearings. Other material covered includes the liberation of the Nazi concentration camps and all the wars in which the U.S. has been involved. Some of the texts include accompanying photos or other illustrations, which you can access by pressing the F9 function key.

The search mode is the title's best feature. It lets you search by subject or word using AND, OR, NOT, or

OFF Boolean operators and * or ? wildcards.

Words and pictures alone don't necessarily make an effective CD-ROM title. Still, despite its lack of multimedia glitz, U.S. History is worth a look for history buffs.

Price: \$395.

Company: Bureau of Electronic Publishing, 141 New Rd., Parsippany, NJ 07054, (800) 828-4766, (201) 808-2700, Fax: (201) 808-2676.

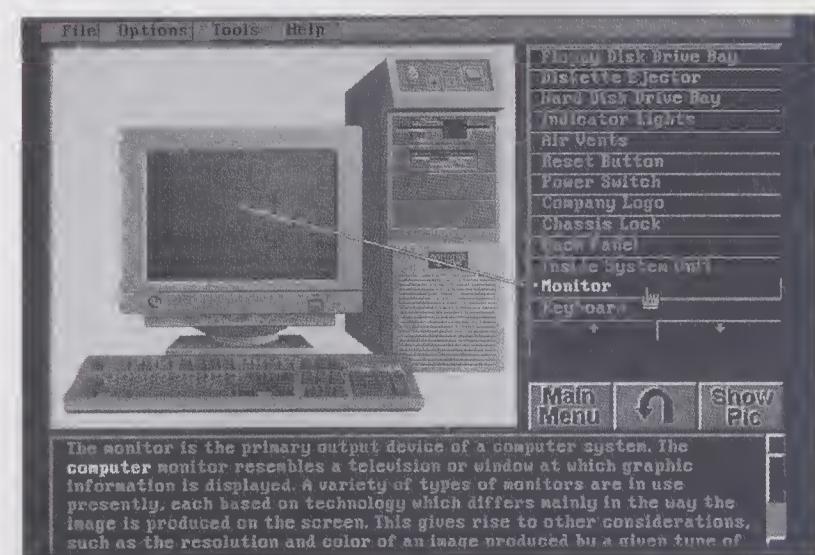
Computer Works

The mission of Computer Works is to teach you about computers — system units, circuit boards, disk storage, displays, keyboards and mice, printers, cables, and software — the works.

It's a mouse-supported DOS program that you can run under Windows, and it teaches by way of colorful illustrations and explanatory text. When you click on a picture of a CRT display, the program draws a line to the term "CRT display" in a listing of computer components to the right of the screen and fills the bottom of the screen with several paragraphs of text detailing the ins and outs of focusing electrons, selection irradiation, phosphors, pixels, and electronic guns.

There's more. Click on the term "CRT display," and you're shown the inside of a monitor, with a new set of terms appearing to the right. Click on any of these terms — electron guns, phosphor coating, yoke, focusing electrodes, and monitor housing — and you're presented with more explanation.

The graphics are well drawn and the text is well written, but Computer



Works doesn't make much use of its multimedia potential. There's only very limited animation and sound. When you're exploring keyboards, for instance, the keys on the keyboard illustrated on the screen move up and down randomly. Sound is limited to indications of right or wrong answers when you're taking the included quiz.

Computer Works also goes only so far in presenting detail. There's no mention, for instance, of the differ-

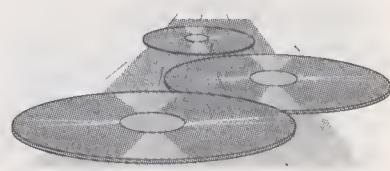
ence between server-based and peer-to-peer networks. Computer novices may find Computer Works to be an attractive and somewhat useful way of boning up on computer jargon, but they shouldn't expect it to make them experts.

Price: \$79.95.

Company: Software Marketing Corp., 9830 S. 51st St., Building A-131, Phoenix, AZ 85044, (602) 893-3377, Fax: (602) 893-2042.

ENTERTAINMENT

All work and no play make for boring times. Fortunately, there are lots of entertainment oriented CD-ROMs out there.



Cinemania

This is a must-have for movie buffs. It's a fun, interactive way to explore the world of movies, the people involved, and filmmaking in general.

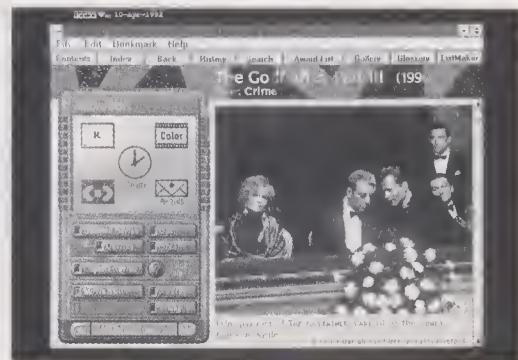
There are lots of ways to use this Windows-based program. To start, you can browse through information on more than 19,000 movies. If you can't remember the name of a movie, the index helps you find it. You can select the genre, the MPAA rating, the director, the performers, any awards it's won, and a range of years in which you think the film was made.

Each included movie has a Leonard Maltin capsule review, a star rating — from one to four stars — and a list of the cast and the director. Listings for 745 of the major films also include detailed reviews and lists of production credits. Some of the films include movie stills and dialogue clips — this is where Cinemania's multi-

media potential really shines. It's simply fun hearing Dorothy say, "I have a feeling we're not in Kansas anymore."

You can also go straight to Cinemania's multimedia features by clicking on Gallery at the top of any screen. Cinemania's use of multimedia is fun, but it doesn't go quite far enough. Of the 19,000 films covered, only 100 include dialogue clips, and none include video clips.

Still, the breadth of the material is impressive. Included are biographies of nearly 3,000 movie personalities, with photos. There are articles on filmmaking techniques and the major studios and a glossary of film terms, taken from the hardcover books the Motion Picture Guide and the Encyclopedia of Film. There's also a



listing of all the Academy Awards.

Cinemania's hypertext links make it easy to jump from one related subject to another. If you're reading a capsule review and want to read the biography of one of its stars, just click on the star's name in the review.

Price: \$79.95.

Company: Microsoft Corp., One Microsoft Way, Redmond, WA 98052, (800)426-9400, (206)882-8080.

The Grammy Awards

This title is to music what Cinemania is to film. The Grammy Awards is a retrospective to the country's national music awards that covers the dates 1958 to 1991.

There are two main ways to use this DOS-based title, depending on whether entertainment or knowledge is your goal. You can watch multimedia presentations of any year's nomi-

nees and winners, though neither sound nor pictures are available for the years 1958 to 1961 and 1963. The other years' presentations include music clips and photos — there's nearly an hour's worth of music clips in all.

Or, if you're searching for specific information, you can search by group, individual artist, year, category, title,

or record label. A trivia feature is included so you can test your knowledge or compete with others.

The Grammy Awards suffers from a lack of speed, however — moving from one section to another can be slow. There's also no way to move directly to the music clips as there is to move to the sound clips in Cinemania. And the Grammy Awards

doesn't provide the kind of detailed text material that makes *Cinemania* valuable for serious fans. But the most vexing problem was that I couldn't get any sound from the title,

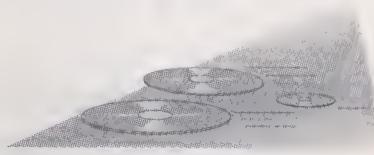
and the manual includes only the briefest of troubleshooting sections.

Still, at its attractive price, the Grammy Awards may be worth a look.

Price: \$59.95

Company: Compton's New Media, 2320 Camino Vida Roble, Carlsbad, CA 92009, (800) 862-2206, (619) 929-2500.

CD-ROMs have amazing capabilities, but not all CD-ROM titles realize their potential. The technology is still new, both on the hardware and software sides. In the future, improved speed, better compression, and multimedia enhancements will make CD-ROMs that much more attractive. ■



Where to Buy CD-ROMs

Buying CD-ROM titles today is easier than ever. There are numerous vendors that either specialize in CD-ROMs or carry large inventories of CD-ROM titles. These include:

Mail Order Suppliers

CD ROM Access
27361 Moody Rd.
Los Altos, CA 94022
(800) 959-5260
(415) 541-2400
Fax: (415) 541-2400.

Free Spirit Software
109 W. Pearl St.
Travalgar, IN 46181
(800) 638-5757
(317) 638-5757
Fax: (317) 878-4751.

CD-World
2650 Wedgefield Rd.
Sumter, SC 29154
(803) 481-2276
BBS: (803) 481-7149

Dustin Discount Software
20969 Ventura Blvd.
Woodland Hills, CA 91364
(800) 274-6611
(818) 710-9174
Fax: (818) 884-5310.

ComputAbility
P.O. Box 17882
Milwaukee, WI 53217
(800) 558-0003
(414) 357-8187
Fax: (800) 554-9981.

TigerSoftware
800 Douglas Entrance
Executive Tower, 7th Floor
Coral Gables, FL 33134
(800) 888-4437
(305) 443-8282
Fax: (305) 529-2990

Meckler Publishing
CD ROMS in Print
11 Ferry Lane West
Westport CT 06880
203-226-6967

Toshiba America
Disk Products Division
9740 Irvine Blvd.
Irvine, CA 92718
(714) 583-3111
Fax: (714) 583-3133

Wedgwood Rental
5316 Woodway Dr.
Fort Worth, TX 76133
(800) 433-2938
(817) 292-7396.

Disk Cache Programs

Supporting CD ROM Readers
Norton Speedcache Plus
Symantec Corp.
10201 Torre Ave.
Cupertino, CA 95014
(800) 441-7234

Symantec Corp., *(continued)*
(408) 252-3570
Fax: (800) 800-1438
Price: \$99

Super PC-Kwik
PC-Kwik Corp.
15100 SW Koll Parkway
Beaverton, OR 97006
(800) 274-5945
(503) 644-5644
Fax: (503) 646-8267
Price: \$79.95.

Lightning CD
Lucid Corp.
101 W. Renner Rd.
Suite 450
Richardson, TX 75082
(800) 925-8243
(214) 994-8100
Fax: (214) 994-8103
Price: \$99.95.

Programs

ProCD
ProPhone
8 Doaks Lane
Little Harbor
Marblehead, MA 01945
617-631-9200
Fax: 617-631-0810
Price: \$295

Warranty Horror Stories

And how not
to become one.

As often occurs in dramatic exposés, names have been changed to protect the innocent.... Frank Floppy paid top dollar for a "screamin' 486 DX" machine from a local computer dealer. However, once he got the machine home, he discovered that it ran sluggishly compared to similar machines at his office—and compared to the

demonstration machine in the store, too. He complained several times to the dealer, but was told he wasn't using his software properly. Finally, after a couple of weeks, he decided to return the machine—only to be told that the 30-day money-back guarantee that came with the computer was not valid for his particular model.

Since her business depends on her

computer being operational, Carrie Coprocessor ordered a machine from a popular mail-order vendor that advertised toll-free technical support and "two-day on-site service". A few weeks after the computer was shipped, it started reporting memory errors. She called technical support, but was unable to get through to a technician. An operator took her telephone number and she was called back the next day. The technical support specialist said she needed a new motherboard, but that since the company was experiencing a parts shortage it might be weeks before they could send her one. It took more than a month—during which she was forced to rent another computer to run her business.

Victor Video purchased 10 computers "at a price too good to be true" in order to set up a small Novell network in his office. Problems began almost immediately. The network kept crashing, and, what's more,

some of his software (including his favorite, *Flight Simulator*) wouldn't run. He called in a \$1,000-per-day network specialist, only to learn that not only were his new computers not Novell-certified, but that because they used a "no-name" BIOS chip, they weren't even 100 percent IBM-compatible. Since he was within his warranty's 60-day return "window," he was able to return the computers—however, to his dismay, he learned that, according to the fine print on his warranty, he was obliged to pay a 20 percent "restocking" fee.

Marylou Monitor bought a name-brand printer from a local dealer. When it stopped working a few weeks later, she learned that she was technically the second owner of the printer (her dealer had purchased it himself from an overseas dealer) and therefore not covered by the manufacturer's warranty. She wound up having to pay hundreds of dollars for repairs that would have been free had she purchased her printer from an authorized dealer. (What's more, since her authorized repair person took care of his own customers' repair needs first, her repairs wound up taking weeks longer than they needed to.)

All of these people—and the millions of others with similar stories to tell—have something in common, besides a lot of unnecessary grief, inconvenience, and expense: an inferior computer warranty.

Warranty Basics

What is a warranty? "It's the statement of how the computer company will treat you after it's taken your money," says William A. Tanenbaum, an attorney specializing in computer law with the law firm of Kenyon & Kenyon. There are two parts to a computer warranty: one governing the time period and circumstances under which the computer system can

be returned, and the other detailing the defects and problems that the company must fix without repair charges. A good warranty is your main—perhaps only—protection in case something goes wrong with your purchase. It pays, therefore, to shop around for a good warranty the same way you would for any other important computer component.

How do you recognize a high-quality warranty? The same way you judge any other computer component—by analyzing its specifications and making an informed choice. One of your first acts when considering a computer purchase should be to request a written copy of the complete warranty from the manufacturer. Some manufacturers will be reluctant to provide this document; if yours is, it's probably best to shop elsewhere. Once you get a copy of your warranty, read it thoroughly. If you have trouble with the legalese, request a written explanation of any unclear sections from the company's customer service department.

Expect to pay more for a computer with a good warranty—maybe a couple of hundred dollars more than for a comparable unit with a poor one. Consider the money a well-spent investment in the smooth running of your office and your own peace of mind. (Remember that you'll spend far more than a couple of hundred dollars trying to get restitution from a crooked computer dealer without the protection of such a warranty.) Roy Sovin, director of service operations at Dell Computer Corporation, recommends asking yourself, "What will it cost me if I don't have use of this equipment?" and to factor in not just monetary costs, but time and personnel costs as well.

Use warranties the same way old-time miners used canaries: as the first sign of impending danger. Since technical support and other warranty ben-

efits are very expensive for a company to provide, companies try to minimize the expenses. They generally choose one of two ways: by producing a superior product to begin with, or by offering a shoddy warranty. A company that has faith in the quality and longevity of its hardware will offer a warranty that reflects that faith. Below, we discuss things to look for when evaluating a warranty, and pitfalls to avoid.

Who's Providing the Warranty?

If you are buying a brand-name computer such as IBM, Compaq, NEC, HP, or Everex from a local or mail-order dealer, make sure that he or she is an authorized reseller for that manufacturer. Unauthorized dealers either purchase equipment illegally on the "gray market" or resell stolen goods. In either case, you may not be able to enforce the warranty against the manufacturer. To determine whether a dealer is authorized, look for the manufacturer's logo displayed on the premises and in its sales literature, and to be perfectly sure that your dealer is authorized, call the manufacturer's toll-free customer-support telephone number and ask.

Make sure you know who is providing your warranty. If you're buying a name-brand PC from an authorized dealer, your warranty may be honored partly by the manufacturer (who may have a technical-support telephone number) and partly by the dealer (who may provide technical support and repair services). Note that the ratio of manufacturer/dealer support varies from manufacturer to manufacturer—and that some companies, such as IBM and Compaq, are notorious for deflecting problems to the local dealers. In these cases it is especially important to purchase from a dealer you trust and who has a good

reputation, even if his or her prices aren't the lowest. (Keep in mind, also, that although legitimate dealers will honor a valid warranty no matter where you've purchased your system, they'll often give priority repair service to those who purchased from them.)

Purchasers of mail-order computers from companies such as Dell, ZEOS, and Northgate generally have a simpler warranty situation than those buying from resellers, since the warranty is provided solely by the company without any intermediaries. Remember that even the best warranty is nothing but paper if the company that issues it goes out of business. Therefore, try to ascertain the stability of the company you're dealing with. Has it been in business for a few years? Are its financial prospects good? The computer industry is notoriously volatile, and last year's leader can easily be this year's leading bankruptcy story. Read the financial section of a major newspaper or, if you're serious about making the right choice, have Dun & Bradstreet or another financial service run a credit report. Such a service costs only about \$20.

Also consider the character of the company you're dealing with. Does it have a reputation for doing well by its customers? Does it willingly present customer references? Or, conversely, does it have a record of consumer dissatisfaction and complaints? A call to the Better Business Bureau office nearest the company will be helpful here; user groups and computer bulletin boards are also excellent sources of information on both local and mail-order companies.

Time Period The statement of the length of the warranty is one of the most important parts of the entire document. In particular, make sure your warranty doesn't expire before you have had a chance to buy (and

test) all your important peripheral hardware and software.

Exclusions "A warranty is only as good as its exclusions and limitations," says Tanenbaum, referring to statements of what is not covered by all or part of the warranty. Common exclusions include "geography" (those living in remote areas might not have access to on-site service) and "reasonable use" (PCs being used in unusually hot or dusty environments may not be covered). Another common exclusion involves certain "special" components such as high-quality monitors or printers—your system's warranty may stipulate that these are covered by a warranty provided by their manufacturer. If there's any doubt about whether you qualify for the full warranty, ask your salesperson and request that he or she confirm your eligibility in writing.

Return Policy The computer arrives, and you don't want it. You don't like the color, or it doesn't run your software, or it's not fast enough. A decent warranty will give you a grace period—generally around 30 days—during which you can return it, no questions asked, without penalty. (You will, however, probably have to pay return shipping.) You must return the computer in "unused" shape, and bundled in all of the original packing materials. (In general, it's a good idea to save all your packing materials for at least 90 days, in case you need to return all or part of a shipment.) Of course, you must also return all the software and manuals that came with the machine.

Some companies don't allow any returns. Others charge a "restocking fee" of 5 to 25 percent of the cost. Try to buy a computer from a company offering a generous return policy, and that doesn't charge a restocking fee.

Technical Support The availability of someone from the company to answer your hardware-related questions

and help troubleshoot problems is one of the most important elements of your warranty. Both local and mail-order companies should provide telephone technical support. Mail-order companies should provide a toll-free technical support number.

But just because a company offers a telephone number, that doesn't mean the support will be available when you need it. Find out the hours during which the technical support department is open. Most computer stores are open only during standard business hours, although if you buy a name-brand computer such as IBM or Everex, you may have access to extended hours of technical support directly from the manufacturer. Some dealers—whether they state it openly, up front, or not—will expect you to get all of your technical support from the manufacturer, and vice-versa.) Mail-order vendors typically offer many more hours of technical support—for example, 16 hours per day/five days a week (Dell) or, in exceptional cases, 24 hours a day/seven days per week (ZEOS). If you do a lot of your work at odd hours, you may value extended technical support.

Finding out the hours of technical support is only your first step. Try to assess the quality of the technical support by actually calling in. Do you reach an operator within five minutes? Or are you left on hold for a long time, only to be transferred to a technical support "operator" who will take a message so someone can call you back? In the second case, how long does it take for the technical support specialist to return your call? How competent is he or she at answering your questions? And how patient? Call the company at different times and over the course of at least a week to try to get a representative sampling of a company's technical support offerings.

Finally, find out how long techni-

cal support (as distinct from repairs, below) lasts. Many companies offer it for the lifetime of the computer, although you're statistically most likely to need it in the first 90 days of ownership.

Repairs What if your computer malfunctions? Your first step will be to call technical support. The specialist you speak with will probably ask you questions to try to determine whether there really is a problem (a lot of "problems" turn out to be due to customer confusion or naïveté, or nonhardware causes such as viruses or buggy software). Once it's determined that there is a problem, he or she will guide you through some basic troubleshooting to try to pin down the cause and, if possible, fix it. If the problem requires either professional attention, or replacement parts, the "repairs" part of your warranty comes into play.

The basic questions to ask about repairs are: what's included, and for how long. Don't accept less than a year of parts-and-labor coverage, meaning you won't have to pay for any repairs required in the first year after purchase. (Most computer breakdowns occur in the first 90 days.) Beware of mail-order companies that don't pay for shipping of both defective and replacement parts, and local companies that charge a "bench" or "estimating" fee, or that ship the computer off-site for repairs. (While it's legitimate to do the latter, it will generally take longer for your computer to be repaired.)

Look for companies that guarantee a 24- or 48-hour turnaround time on repairs. Many mail-order companies will ship replacement parts via overnight courier. And be aware that most companies only offer that guarantee pending availability of parts—if the parts aren't in, you may wind up waiting days or even weeks for a repair. (Some local dealers will lend

you another machine if you're forced to wait a long time for a repair—ask them to commit to the conditions for such a loan in writing.)

Finally, make sure that your warranty includes a provision guaranteeing that any replacement parts put into your computer are new and not reconditioned. (You've paid for new parts; you should get them.) And if your warranty does carry that guarantee, make sure you actually get those new parts: if you're suspicious, ask your dealer for the broken parts or the boxes from the replacements.

How long should your warranty's repair clause be in effect? Many companies offer not one but two years of parts-and-labor repair coverage, with the extra year costing around \$70. That's not much to spend on a year's peace of mind, but it's generally not essential.

On-Site Service and Service Contracts Most consumers misunderstand the concept of on-site service. It's very expensive for a mail-order company to provide it, and therefore they try to use it only as a last resort. Whenever possible, even a good company will try to encourage you to solve a problem yourself, even if it means replacing a part. If you feel a company is pressuring you to do repairs or troubleshooting you're uncomfortable with, and on-site service is part of your warranty, insist on your rights being honored.

When purchasing a computer, you want a warranty that includes two-day on-site service—otherwise you could wind up waiting weeks for your support call. Also, make sure that on-site service is available in your location. Mail-order companies generally subcontract on-site work to third-party repair companies such as General Electric or TRW—try to find out which your company would be using, and what level of support they have purchased. (Repair companies offer

varying levels of protection; if your computer company has contracted for a low level, you may not get service promptly.) You may need to talk with both the computer company and the repair company to get this information.

Local computer companies may also provide on-site service, although they generally refer to it as a service contract. Make sure the contract provides the level of support you require. It may stipulate a guarantee that telephone calls will be responded to within six hours, and an on-site visit arranged within 24 hours.

Final Thoughts— And What to Do If It's Too Late

Remember—if a company doesn't offer the level of warranty support you want, shop around. Someone probably does. (If no one does, you're probably trying to pay too little for true quality hardware—an unwise economy.)

If it's too late—meaning, if you've already purchased a computer with an unsatisfactory warranty—you may not be out of luck. Writing to the company's director of technical support or even president can sometimes bring results. If that doesn't work, consider posting your grievance on CompuServe or another widely read BBS (or local BBS's, in the case of a local dealer). Doing so often embarrasses recalcitrant companies into righteous action, but make sure you have your facts (and documentation) in order or you could face a libel lawsuit.

If the company is unable or unwilling to satisfy its warranty, remember that Federal law (the 1975 Magnuson & Moss Warranty Act) mandates that it both provide and honor a warranty. You thus have legal recourse in the event of problems, and there are many

federal and state agencies you can call on to intercede on your behalf. Most counties and municipalities have a consumer affairs department with which you can file a complaint against a fraudulent manufacturer. Start with your municipality's office, if one exists. Send copies of all correspondence (see below) along with a detailed history of the problems you've been experiencing with the company.

If you don't get satisfaction at the municipal level, proceed to the county level. Other areas of recourse include the Attorney General's office in the state the company is located in—this office is prepared to investigate companies suspected of fraud and other illegal practice—and the regional Better Business Bureau, which can act as an arbiter in case of dispute. If you get no recourse at the state or local level, you can also file a complaint with the Federal Trade Commission (FTC).

Now, suppose the company is happy to do repairs as its warranty states, but you've come to realize that the system you bought is a lemon that needs constant repair. Even when the company provides you with a new system of the same model, it still gives you constant trouble, leading to time without your computer several times a year. Don't worry, you're still covered. Warranties offered by manufacturers are called express warranties, meaning that the company has stated its own warranty provisions. The Uniform Commercial Code (UCC), which exists in most states in the U.S. has provided you with two additional safety nets: an "Implied Warranty of Merchantability," and an "Implied Warranty of Fitness for a Particular Purpose." The first implied warranty states that, no matter what the manufacturer's warranty says, the product you bought must be usable for its intended purpose. The Warranty of Fitness for a Particular Purpose

says that if, for example, you told your dealer or mail order house that you needed the computer to use as a server on a Novell network, and the dealer says, "yes, this one will do," the computer has to live up to that claim, even if the manufacturer makes no such claims. In both cases, if the computer does not live up to its implied warranties, you are entitled to a refund from whoever sold you the product. This generally means the dealer, not the manufacturer, unless you purchased the product through the direct channel.

This aspect of the UCC is interpreted differently in different states, but decisions have generally fallen on the side of the buyer. Some states allow implied warranties to remain in effect many months, even years, after the manufacturer's warranty has expired. In the case of the Implied Warranty of Fitness for a Particular Purpose, it obviously helps if you have some written proof of the dealer's promises.

Diana Busch, owner of Legally Yours, a paralegal-services and consumer-advocacy company, offers the following advice to those experiencing

problems with a computer company: document everything in writing; take copious notes during telephone calls; and always get the full name, title, and location of company representatives you speak with. Send the company registered letters confirming the details of all telephone calls. Include the serial numbers of all goods in question, and include "cc:" (carbon copy) notations at the bottom to alert the company that you're involving government agencies in the matter. Also include either a deadline (seven days, for example, or one mutually agreed upon) for the company to respond to your letter or to perform any agreed-upon action.

Finally, consider bringing in a computer consultant or a lawyer specializing in computer-related issues, both for objective advice and to help you argue your case with the company. Computer professionals tend to have a lot of experience with, and are less easily intimidated by, obnoxious or dishonest computer companies. And, of course, sometimes a single letter from a lawyer can bring about faster action than 10 letters from nonlawyers. ■



Serial Port Adapters

If you're having trouble configuring a new mouse or other input device, the problem may be as simple as your serial port adapter. Many 9-to-25-pin serial adapters don't carry through all 9 (or 25) pins from plug to port; some only have the wires necessary for certain devices.

One of our editors recently spent an hour fiddling with interrupt selections and DIP switches when the whole problem was that little adapter. (Happy ending: he had an adapter with the full set of pins in his desk drawer.)

PC UPGRADE

THE GUIDE TO BUILDING AND EXPANDING COMPUTER SYSTEMS

PRODUCT COMPARISON CHARTS

Contents

Page

Hard Disk Drives	66
CD-ROM Drives	74
Street Price Guide.....	79
Hard Disk Drives	79
Floppy Disk Drives	82
Sound Boards	83
CD-ROM Drives	84
Memory Upgrades.....	85
Software	86
Dealers	88

Comprehensive, feature-by-feature comparisons of leading products to help you make an informed buying decision as you upgrade or expand your computer system.

COMPARISON CHART: HARD DISK DRIVES 500Mb & GREATER

COMPARISON CHART: HARD DISK DRIVES

Make/Model	Drive Height	Drive Type	Form Factor	* Mounting	Formatted Drive Capacity	Average Seek Time	Avg. Track To Track	Data Transfer Rate	** MTBF (hrs.)	Utility Software	Power Consumption (Watts)	Other Features	Works With	Price
Procom Technology PR-IDE500	half-height	IDE	3-1/2 inch	—	510Mb	12ms	3ms	5Mb/sec.	150,000	utility	35	installation kits available for most PC-compat., Compaq Deskpro	IBM PC & compat., Compaq Deskpro	\$1,265
PROPAQ	—	IDE	3-1/2 inch	—	510Mb	12ms	3ms	5Mb/sec.	150,000	drivers, utilities	35	installation kits for most PC-compat., Compaq Deskpro	IBM PC & compat., Compaq Deskpro	1,525
Si1003	half-height	SCSI-2	3-1/2 inch	—	1050Mb	10ms	—	4Mb/sec.	200,000	SCSI drivers, utility	10	5-yr. warranty	all SCSI-equipped PCs	2,295
Si650	full-height	SCSI	5-1/4 inch	—	676Mb	15.5ms	—	1.8Mb/sec.	150,000	SCSI drivers, utilities	24	installation kits for most systems, COMPSURF prepared for NetWare installations	IBM PC & compat.	2,325
Si1000	full-height	SCSI	5-1/4 inch	—	1050Mb	15ms	—	2.8Mb/sec.	150,000	SCSI drivers, utilities	24	installation kits for most systems, COMPSURF prepared for NetWare installations	IBM PC, XT, AT, & compat.	2,475
MD1003	half-height	SCSI-2	3-1/2 inch	E	1050Mb	10ms	—	4Mb/sec.	200,000	SCSI drivers, utility	10	installation kits for most systems, COMPSURF prepared for NetWare installations	all SCSI-equipped PCs	2,495
Si1353	half-height	SCSI-2	5-1/4 inch	—	1420Mb	15ms	—	4Mb/sec.	150,000	SCSI drivers, utility	10	installation kits for most systems, COMPSURF prepared for NetWare installations	all SCSI-equipped PCs	2,695

* I = Internal E = External ** MTBF = Mean Time Between Failures

All prices are U.S. suggested list.

N/A = Not applicable

— = Information not available at press time.

Make/Model	Drive Height	Drive Type	Form Factor	* Mounting	Formatted Drive Capacity	Average Seek Time	Avg. Track To Track	Data Transfer Rate	** MTBF (hrs.)	Utility Software	Power Consumption (Watts)	Works With	Price	
MTD650	full-height	SCSI	5-1/4 inch	E	676Mb	15.5ms	—	1.8Mb/sec.	150,000	SCSI drivers, utilities	—	external SCSI ID, termination	IBM PC & compat.	2,725
MTD650	full-height	SCSI	5-1/4 inch	E	676Mb	15.5ms	—	1.8Mb/sec.	150,000	SCSI drivers, utility	—	external SCSI ID, termination	all SCSI-equipped PCs	2,725
MTD1000	full-height	SCSI	5-1/4 inch	E	1050Mb	15ms	—	2.8Mb/sec.	150,000	SCSI drivers, utilities	—	external SCSI ID, termination	IBM PC & compat.	2,825
MTD1000	full-height	SCSI	5-1/4 inch	E	1050Mb	15ms	—	2.8Mb/sec.	150,000	SCSI drivers, utility	—	external SCSI ID, termination	all SCSI-equipped PCs	2,825
MD1353	half-height	SCSI-2	5-1/4 inch	E	1420Mb	15ms	—	4Mb/sec.	150,000	SCSI drivers, utility	10	installation kits for most systems, COMPSURF prepared for NetWare installations	all SCSI-equipped PCs	2,895
MD1003	half-height	SCSI	3-1/2 inch	E	1050Mb	10ms	—	—	150,000	SCSI drivers, utilities	—	5-yr. warranty	IBM PC & compat.	2,995
MD1003	half-height	SCSI	3-1/2 inch	E	1050Mb	10ms	—	—	150,000	SCSI drivers, utility	—	5-yr. warranty	all SCSI-equipped PCs	2,995
Si1350	full-height	SCSI	5-1/4 inch	I	1420Mb	15ms	—	4Mb/sec.	150,000	SCSI drivers, utilities	—	installation kits for most systems, COMPSURF prepared for NetWare installations	IBM PC, XT, AT, & compat.	3,545
Si1900	full-height	SCSI	5-1/4 inch	I	1900Mb	13ms	—	4Mb/sec.	150,000	SCSI drivers, utilities	10	installation kits for most systems, COMPSURF prepared for NetWare installations	IBM PC & compat.	3,865
Si1900	full-height	SCSI	5-1/4 inch	I	1900Mb	13ms	—	4Mb/sec.	150,000	SCSI drivers, utility	—	installation kits for most systems, COMPSURF prepared for NetWare installations	all SCSI-equipped PCs	3,865

COMPARISON CHART: HARD DISK DRIVES

Make/Model	Drive Height	Drive Type	Form Factor	* Mounting	Formatted Drive Capacity	Average Seek Time	Avg. Track To Track	Data Transfer Rate	** MTBF (hrs.)	Utility Software	Power Consumption (Watts)	Other Features	Works With	Price
MTD1350	full-height	SCSI	5-1/4 inch	E	1420Mb	15ms	—	4Mb/sec.	150,000	SCSI drivers, utilities	—	external SCSI ID dial & termination	IBM PC & compats.	3,995
MTD1350	full-height	SCSI	5-1/4 inch	E	1420Mb	15ms	—	4Mb/sec.	150,000	SCSI drivers, utility	—	external SCSI ID dial and termination	all SCSI-equipped PCs	3,995
MTD1900	full-height	SCSI	5-1/4 inch	E	1900Mb	13ms	—	4Mb/sec.	150,000	SCSI drivers, utility	10	installation kits for most systems, COMPSURF prepared for NetWare installations	all SCSI-equipped PCs	4,165
MTD1900	full-height	SCSI	5-1/4 inch	E	1900Mb	13ms	—	4Mb/sec.	150,000	SCSI drivers, utilities	—	external SCSI ID dial & termination	IBM PC & compats.	4,255
MTD1900	full-height	SCSI	5-1/4 inch	E	1900Mb	13ms	—	4Mb/sec.	150,000	SCSI drivers, utility	—	external SCSI ID dial and termination	all SCSI-equipped PCs	4,255
Si2003	half-height	SCSI-2	3-1/2 inch	I	2.1Gb	9ms	1.5ms	5Mb/sec.	500,000	SCSI drivers, utility	—	installation kits for most systems, COMPSURF prepared for NetWare installations	all SCSI-equipped PCs	4,495
MTD2003	half-height	SCSI-2	3-1/2 inch	E	2.1Gb	9ms	1.5ms	5Mb/sec.	500,000	SCSI drivers, utility	—	installation kits for most systems, COMPSURF prepared for NetWare installations	all SCSI-equipped PCs	4,695
Si2000	full-height	SCSI-2	5-1/4 inch	I	2.1Gb	11ms	—	5Mb/sec.	150,000	SCSI drivers, utility	38	installation kits for most systems, COMPSURF prepared for NetWare installations	all SCSI-equipped PCs	5,195
Si2000	full-height	SCSI	5-1/4 inch	I	2Gb	11ms	—	4Mb/sec.	150,000	SCSI drivers, utilities	—	installation kits for most systems, COMPSURF prepared for NetWare installations	IBM PC & compats.	5,425

COMPARISON CHART: HARD DISK DRIVES

Make/Model	Drive Height	Drive Type	Form Factor	* Mounting	Formatted Drive Capacity	Average Seek Time	Avg. Track To Track	Data Transfer Rate	** MTBF (hrs.)	Utility Software	Power Consumption (Watts)	Other Features	Works With	Price
MTD2000	full-height	SCSI	5-1/4 inch	E	2Gb	11ms	—	4Mb/sec.	150,000	SCSI drivers, utilities	—	external SCSI ID dial & termination	IBM PC & compacts.	5,795
MTD2000	full-height	SCSI-2	5-1/4 inch	E	2.1Gb	11ms	—	5Mb/sec.	150,000	SCSI drivers, utility	38	installation kits for most systems, COMPSURF prepared for NetWare installations	all SCSI-equipped PCs	5,795
MTD2000	full-height	SCSI	5-1/4 inch	E	2Gb	11ms	—	4Mb/sec.	150,000	SCSI drivers, utility	—	external SCSI ID dial and termination	all SCSI-equipped PCs	5,795
Si2900	full-height	SCSI-2	5-1/4 inch	I	2.9Gb	11.5ms	—	7Mb/sec.	200,000	SCSI drivers, utility	34	installation kits for most systems, COMPSURF prepared for NetWare installations	all SCSI-equipped PCs	7,295
MTD2900	full-height	SCSI-2	5-1/4 inch	E	2.9Gb	11.5ms	1.5ms	7Mb/sec.	200,000	SCSI drivers, utility	34	installation kits for most systems, COMPSURF prepared for NetWare installations	all SCSI-equipped PCs	7,595
Quantum Corp. ProDrive LPS 540 S/AT	—	IDE-AT or SCSI-2	3-1/2 inch	I	540Mb	12ms	4ms	46Mbit/sec.	300,000	adaptive segmentation, WriteCache, & DisCache firmware	.8	AutoTransfer ASIC hardware	IBM PC & compacts., Macintosh	—
Empire 540 S	—	Fast SCSI-3	3-1/2 inch	I	540Mb	9.5ms	1.8ms	48Mbit/sec.	500,000	MultiCache 6, ORCA, Write Cache, DisCache firmware	6	AutoRead/Auto Write ASIC hardware, tagged command queuing	major workstations & networks	—
Empire 1080 S	—	Fast SCSI-3	3-1/2 inch	I	1080Mb	9.5ms	1.8ms	48Mbit/sec.	500,000	MultiCache 6, ORCA, Write Cache, DisCache firmware	6	AutoRead/Auto Write ASIC hardware, tagged command queuing	major workstations & networks	—

COMPARISON CHART: HARD DISK DRIVES

Make/Model	Drive Height	Drive Type	Form Factor	* Mounting	Formatted Drive Capacity	Average Seek Time	Avg. Track To Track	Data Transfer Rate	** MTBF (hrs.)	Utility Software	Power Consumption (Watts)	Other Features	Works With	Price
ProDrive 1800 S	—	SCSI-2	3-1/2 inch	—	1.8Gb	10ms	3ms	40Mbit/sec.	350,000	—	.8	tagged command queing with seek reordering	major workstations & networks	—
ProDrive 700 S	half-height	SCSI-2	3-1/2 inch	—	700Mb	10ms	3ms	38Mbit/sec.	350,000	Write Cache & DisCache firmware	13	tagged command queing with seek reordering	major workstations & networks	—
ProDrive 1225 S	half-height	SCSI-2	3-1/2 inch	—	1.2Gb	10ms	3ms	38Mbit/sec.	350,000	Write Cache & DisCache firmware	13	tagged command queing with seek reordering	major workstations & networks	\$1,225
SDI SHD-780	—	SCSI	3-1/2 inch	E	670Mb	16ms	—	9Mbit/min	150,000	—	8	connection via parallel port	—	—
SHD-1400	—	SCSI	5-1/4 inch	E	1.2Gb	13.5ms	—	9Mbit/min	150,000	—	8	connection via parallel port	—	\$3,199
Seagate Wren ST4702N	full-height	SCSI	5-1/4 inch	—	613Mb	16.5ms	3ms	12-16Mbit/sec.	100,000	—	27	—	OEM only	—
Wren ST4767N	full-height	SCSI-2	5-1/4 inch	—	676Mb	11.9ms	2.5ms	24Mbit/sec.	100,000	—	27	—	OEM only	—
Wren ST4769E	full-height	ESDI	5-1/4 inch	—	691Mb	12.9ms	2.5ms	22Mbit/sec.	100,000	—	27	—	OEM only	—
Wren ST4766N	full-height	SCSI	5-1/4 inch	—	676Mb	15.5ms	3ms	15Mbit/sec.	100,000	—	21	—	OEM only	—
Wren ST4766E	full-height	ESDI	5-1/4 inch	—	676Mb	15.5ms	3ms	15Mbit/sec.	100,000	—	20	—	OEM only	—
ST3600A	low profile	AT (IDE)	3-1/2 inch	—	525Mb	10.5ms	—	19-32Mbit/sec.	200,000	—	5	IBM AT & compats.	OEM only	—
ST3600N	low profile	fast SCSI-2	3-1/2 inch	—	525Mb	10.5ms	—	19-32Mbit/sec.	200,000	—	5	IBM PC, XT, AT, & compats.	OEM only	—
ST1581N	—	SCSI-2	3-1/2 inch	—	525Mb	14ms	—	20-32Mbit/sec.	150,000	—	9	—	IBM PC, XT, AT, & compats.	OEM only
ST1980N	half-height	SCSI-2	3-1/2 inch	—	860Mb	9.9ms	—	20-32Mbit/sec.	200,000	—	7	—	IBM PC, XT, AT, & compats.	OEM only

COMPARISON CHART: HARD DISK DRIVES

Make/Model	Drive Height	Drive Type	Form Factor	* Mounting	Formatted Drive Capacity	Average Seek Time	Avg. Track To Track	Data Transfer Rate	** MTBF (hrs.)	Utility Software	Other Features	Works With	Price
ST11200N	half-height	SCSI-2	3-1/2 inch	—	1050Mb	10.5ms	—	18-32Mbit/sec.	200,000	—	7	IBM PC, XT, AT, & compats.	OEM only
Wren ST41200N	full-height	SCSI-2	5-1/4 inch	—	1037Mb	15ms	—	15-23Mbit/sec.	150,000	—	24	—	OEM only
Wren ST41650N	full-height	SCSI-2	5-1/4 inch	—	1415Mb	15ms	—	17-32Mbit/sec.	150,000	—	21	—	OEM only
Wren ST41651N	full-height	SCSI-2	5-1/4 inch	—	1415Mb	15ms	—	17-32Mbit/sec.	150,000	—	21	—	OEM only
Wren ST42100N	full-height	SCSI-2	5-1/4 inch	—	1900Mb	12.9ms	—	20-31Mbit/sec.	150,000	—	21	—	OEM only
Wren ST42101N	full-height	SCSI-2	5-1/4 inch	—	1900Mb	12.9ms	—	20-31Mbit/sec.	150,000	—	21	—	OEM only
Elite ST41520N	—	SCSI-2	5-1/4 inch	—	1352Mb	11.5ms	—	26-36Mbit/sec.	150,000	—	38	—	OEM only
Elite ST41600N	—	SCSI-2	5-1/4 inch	—	1352Mb	11.5ms	—	26-36Mbit/sec.	150,000	—	33	—	OEM only
Elite ST41601N	—	SCSI-2	5-1/4 inch	—	1352Mb	11.5ms	—	26-36Mbit/sec.	150,000	—	29	—	OEM only
Elite 2 ST42400N	—	Fast SCSI-2	5-1/4 inch	—	2129Mb	11ms	1.7ms	30-40Mbit/sec.	150,000	—	33	5-yr. warranty	—
Elite 3 ST43400N	—	Fast SCSI-2	5-1/4 inch	—	2846Mb	11ms	1.7ms	35-52Mbit/sec.	150,000	—	33	5-yr. warranty	—
Elite 3 ST43401N	—	Fast Wide SCSI-2	5-1/4 inch	—	2912Mb	11ms	1.7ms	35-52Mbit/sec.	150,000	—	33	5-yr. warranty	—
Sabre ST8851J	—	SMD-O/E	8-inch	—	727Mb	15ms	—	—	100,000	—	95	—	OEM only
Sabre ST81236J	—	SMD-O/E	8-inch	—	1056Mb	15ms	—	—	150,000	—	95	—	OEM only
ST3600A	—	AT (IDE)	3-1/2 inch	—	540Mb	10.5ms	1.5ms	19-36Mbit/sec.	200,000	—	5.5	IBM AT & compats.	OEM only

COMPARISON CHART: HARD DISK DRIVES

Make/Model	Drive Height	Drive Type	Form Factor	* Mounting	Formatted Drive Capacity	Average Seek Time	Avg. Track To Track	Data Transfer Rate	** MTBF (hrs.)	Utility Software	Other Features	Works With	Power Consumption (Watts)	Price
Elite 2 ST42000N	—	Fast SCSI-2	5-1/4 inch	—	1792Mb	11ms	1.7ms	30-40Mbit/sec.	150,000	—	33	5-yr. warranty	—	OEM only
Elite 3 ST43402ND	—	Fast SCSI-2	5-1/4 inch	—	2912Mb	11ms	1.7ms	35-52Mbit/sec.	150,000	—	33	dual port interface, 5-yr. warranty	—	OEM only
Barracuda 1 ST11750N	half-height	Fast SCSI-2	3-1/2 inch	—	1437Mb	9ms	.9ms	36-56Mbit/sec.	500,000	—	10.7	5-yr. warranty	IBM PC & compats.	OEM only
Barracuda 1 ST11751N	half-height	Fast Wide SCSI-2	3-1/2 inch	—	1437Mb	9ms	.9ms	36-56Mbit/sec.	500,000	—	10.7	5-yr. warranty	IBM PC & compats.	OEM only
Barracuda 2 ST12550N	half-height	Fast SCSI-2	3-1/2 inch	—	2100Mb	9ms	.9ms	36-56Mbit/sec.	500,000	—	12	5-yr. warranty	IBM PC & compats.	OEM only
Barracuda 2 ST12551N	half-height	Fast Wide SCSI-2	3-1/2 inch	—	2100Mb	9ms	.9ms	36-56Mbit/sec.	500,000	—	12	5-yr. warranty	IBM PC & compats.	OEM only
ST11700N	half-height	Fast SCSI-2	3-1/2 inch	—	1430Mb	10.5ms	2ms	25-43Mbit/sec.	500,000	—	9	5-yr. warranty	—	OEM only
ST11701N	half-height	Fast Wide SCSI-2	3-1/2 inch	—	1430Mb	10.5ms	2ms	25-43Mbit/sec.	500,000	—	9	5-yr. warranty	—	OEM only
ST12400N	half-height	Fast SCSI-2	3-1/2 inch	—	2100Mb	10.5ms	2ms	25-43Mbit/sec.	500,000	—	9	5-yr. warranty	—	OEM only
ST12401N	half-height	Fast Wide SCSI-2	3-1/2 inch	—	2100Mb	10.5ms	2ms	25-43Mbit/sec.	500,000	—	9	5-yr. warranty	—	OEM only
ST31200N	low-profile	Fast SCSI-2	3-1/2 inch	—	1050Mb	10.5ms	2ms	32-50Mbit/sec.	500,000	—	7	5-yr. warranty	—	OEM only
ST3600A	low-profile	AT	3-1/2 inch	—	540Mb	12ms	2ms	19-36Mbit/sec.	200,000	—	5.5	2-yr. warranty	—	OEM only
ST3600N	low-profile	Fast SCSI-2	3-1/2 inch	—	525Mb	12ms	2ms	19-35Mbit/sec.	200,000	—	5.5	2-yr. warranty	—	OEM only
ST3601N	low-profile	Fast SCSI-2	3-1/2 inch	—	535Mb	12ms	2ms	19-35Mbit/sec.	200,000	—	5.5	2-yr. warranty	—	OEM only

Make/Model	Drive Height	Drive Type	Form Factor	* Mounting	Formatted Drive Capacity	Average Seek Time	Avg. Track To Track	Data Transfer Rate	** MTBF (hrs.)	Utility Software	Other Features	Works With	Price	
ST3655A	—	AT (IDE)	3-1/2 inch		545.3Mb	12ms	3.5ms	21-36Mbit/sec.	250,000	—	5	IBM AT & compats.	OEM only	
ST3655N	—	Fast SCSI-2	3-1/2 inch		545.3Mb	12ms	3.5ms	21-36Mbit/sec.	250,000	—	5	IBM AT & compats.	OEM only	
Toshiba MK-2428FC	—	AT (IDE)	2-1/2 inch		520Mb	12ms	3ms	31Mbit/sec.	150,000	N/A	2.9	IBM PC & compats.	\$595	
MK-2428FB	—	SCSI-2	2-1/2 inch		520Mb	12ms	3ms	31Mbit/sec.	150,000	N/A	2.9	IBM PC & compats.	725	
MK-438FB	—	SCSI-2	3-1/2 inch		900Mb	12ms	2ms	31.5 Mbit/sec.	200,000	N/A	10	8 platters to achieve a 1Gb unformatted capacity	IBM PC & compat.	775
MK-537FB	—	SCSI-2	3-1/2 inch		1Gb	12ms	2ms	10Mb/sec.	200,000	N/A	10	IBM PC & compats., Macintosh	865	
MK-538FB	—	SCSI-2	3-1/2 inch		1.2Gb	12ms	2ms	10Mb/sec.	200,000	N/A	10	IBM PC & compats., Macintosh	1,015	
MK-538FB	—	SCSI-2	3-1/2 inch		1.2Gb	12ms	2ms	31.5 Mbit/sec.	200,000	—	10	—	—	2,395

HARD DISK DRIVE MANUFACTURERS

Quantum Corp.
500 McCarthy Blvd., Milpitas, CA
95035, (408) 894-4000
(714) 852-1000

Seagate Technology
920 Disc Dr., Scotts Valley, CA
95066-6550, (408) 438-6550
(714) 583-3000

Storage Devices, Inc.
6800 Orangethorpe Ave., Buena Park, CA 90620, (714) 562-5500

Toshiba America Information Systems, Inc.
P.O. Box 19724, Irvine, CA 92713,
(714) 583-3000

COMPARISON CHART: CD-ROM DRIVES

COMPARISON CHART: CD-ROM DRIVES

Make/Model	* Mounting	Adapter Card Incl.	Access Time (ms)	Data Transfer Rate	Transfer Buffer Size	MPC Compatible	Works w/ Audio CD's	Photo-CD Compat.; Single/Multi-Sessions	Software Included	Other Features	Price
Acculogic HomePort/CD	E	—	290ms	150K/sec.	128K	—	Y	Y; Both	CD-ROM extensions, auto installation, CD-demo disk	parallel port interface, printer pass-through port, daisy-chain interface	\$799
CD Technology CD Porta-Drive Model T3401	B	8-bit/16-bit	200ms	330K/sec.	256K	Y	Y	Y; Both	varies w/ price	external power supply, sealed mechanical garage door, auto lens cleaning	\$1,050 (8-bit)/1,150 (16-bit)
Chinon America CDS-435 For PC	I	SCSI	350ms	150K/sec.	64K	Y	Y	Y; —	CD-Audio Play, MS-Extension, Crystal Collection MPC Bundle: San Diego Zoo Animals, MPC World Atlas, MPC US Atlas	cable, Quicktime compat., dip switch termination	\$595
CDS-535 For PC	I	SCSI	280ms	150K/sec.	256K	Y	Y	Y; —	CD-Audio Play, MS-Extensions, Crystal Collection MPC Bundle: San Diego Zoo Animals, MPC World Atlas, MPC US Atlas	dual speed drive	695
CDX-435 For PC	E	SCSI	350ms	150K/sec.	64K	Y	Y	Y; —	CD-Audio Play, MS-Extension, Crystal Collection MPC Bundle: San Diego Zoo Animals, MPC World Atlas, MPC US Atlas	cable, Quicktime compat., dip switch termination	745
CDA-435 For MAC	E	—	350ms	150K/sec.	64K	Y	Y	Y; —	CD-Audio Play, MS-Extension, driver software	SCSI cable, Quicktime compat., dip switch termination	745

* I = Internal E = External B = Both
All prices are U.S. suggested list. — = Information not available at press time. N/A = Not applicable

COMPARISON CHART: CD-ROM DRIVES

Make/Model	* Mounting	Adapter Card Incl.	Access Time (ms)	Data Transfer Rate	Transfer Buffer Size	MPC Compatible	Works w/ Audio CDs	Photo-CD Compat.; Single/Multi-Sessions	Software Included	Other Features	Price
CDX-535 For PC	E	SCSI	280ms	150K/sec.	256K	Y	Y	Y;—	CD-Audio Play, MS-Extension, Crystal Collection MPC Bundle: San Diego Zoo Animals, MPC World Atlas, MPC US Atlas	audio remote control unit, cable, Quicktime compat., dip switch termination	795
	E	SCSI	350ms	150K/sec.	64K	Y	Y	Y;—	CD-Audio Play, MS-Extension, Crystal Collection MPC Bundle: San Diego Zoo Animals, MPC World Atlas, MPC US Atlas	audio remote control unit, cable, Quicktime compat., dip switch termination	845
CDC-435 For MAC	E	—	350ms	150K/sec.	64K	Y	Y	Y;—	CD-Audio Play, MS-Extension, driver software	audio remote control unit, SCSI cable, Quicktime compat., dip switch termination	845
	E	PC adapter card	260ms	307.2K/sec.	128K	—	Y	N;—	none	daisychain up to 8 drives, airtight chassis w/ double-door mechanism	—
Hitachi CDR-6700	E	PC adapter card	390ms	153.6K/sec.	64K	—	Y	N;—	Microsoft CD-ROM extensions disk	incl. CD-ROM cables, daisychain up to 8 drives, airtight chassis w/ double-door mechanism	\$865
	I	PC adapter bus	390ms	153.6K/sec.	64K	—	Y	N;—	none	daisychain up to 8 drives, airtight chassis w/ double-door mechanism	865
CDR-3700PC	I	PC adapter bus	390ms	153.6K/sec.	64K	—	Y	N;—	Microsoft CD-ROM extensions disk	incl. CD-ROM cables, daisychain up to 8 drives, airtight chassis w/ double-door mechanism	\$865
	I	SCSI	390ms	153.6K/sec.	64K	—	Y	N;—	none	daisychain up to 8 drives, airtight chassis w/ double-door mechanism	865
CDR-3750	I	SCSI	390ms	153.6K/sec.	128K	—	Y	N;—	Microsoft CD-ROM extensions disk	incl. CD-ROM cables, daisychain up to 8 drives, dust-free chassis w/ dust proof door	995
	E	ISA adapter card	320ms	153.6K/sec.	128K	—	Y	N;—	Microsoft CD-ROM extensions disk, Hitachi device drivers, audio play	incl. CD-ROM cables, daisychain up to 8 drives, dust-free chassis w/ dust proof door	995

COMPARISON CHART: CD-ROM DRIVES

Make/Model	* Mounting	Adapter Card Incl.	Access Time (ms)	Data Transfer Rate	Transfer Buffer Size	MPC Compatible	Works w/ Audio CD's	Single/Multi-Sessions	Software Included	Other Features	Price
CDR-1750SMAC	E	SCSI	320ms	153.6K/sec.	128K	—	Y	N;—	Macintosh driver, audio play	incl. CD-ROM cables, daisychain up to 8 drives, dust-free chassis w/ dust proof door	995
CDR-1700SMC	E	MCA adapter card	320ms	153.6K/sec.	128K	—	Y	N;—	Microsoft CD-ROM extensions disk, Hitachi device drivers, audio play	incl. CD-ROM cables, daisychain up to 8 drives, dust-free chassis w/ dust proof door	1,095
Introl Introl 600 CD	B	SCSI	310ms	150K/sec.	64K	N/A	Y	N/A	none	compatible with Sun & Silicon Graphics	\$750
Laser Magnetic Storage International CM205	I	PC/AT host adapter card	375ms	176K/sec.	32K	Y	Y	Y; Both	MS-CD ROM Extensions, Windows drivers	2-yr parts/labor warranty, audio & data interface cable	\$400
CM206	E	proprietary	800ms	307K/sec.	64K	Y	Y	Y; multi-session	device driver, Microsoft Extensions	motorized tray loading, dust cover	499
CM215	E	SCSI-2	360ms	154K/sec.	64K	Y	Y	Y; multi-session	device driver, Microsoft Extensions	motorized tray loading, dust cover	499/599 (sub-system)
CM225	E	PC/AT host adapter card	375ms	176K/sec.	32K	Y	Y	Y; Both	MS-CD ROM Extensions, Windows drivers	2-yr parts/labor warranty, audio interface cable	549
CM214	I	SCSI	350ms	153K/sec.	64K	N	Y	N; single	Windows drivers	2-yr parts/labor warranty	549/649 (sub-system)
Legacy Storage Systems CD-ROM 2x	E	SCSI II	200ms	330K/sec.	256K	Y	—	Y; multi-session	resource management utilities	resource management utilities	\$999

Make/Model	* Mounting	Adapter Card Incl.	Access Time (ms)	Data Transfer Rate	Transfer Buffer Size	MPC Compatible	Works w/ Audio CD's	Y; multi-session	MS-CD Extension & Driver Software	Other Features	Price
Liberty Systems Liberty 115 Series CD-ROM	E	SCSI or parallel-to-SCSI	200ms	330K/sec.	256K	Y	Y	Y; multi-session	portable, built-in power supply, built-in parallel-to-SCSI controller	\$699-799	
Philips Consumer Electronics CM 462 BK	E	proprietary	500ms	153K/sec.	32K	Y	Y	Y; multi-session	none	\$499	
CM 405 ABK	I	SCSI-2	265ms	300K/sec.	64K	Y	Y	Y; multi-session	none	599	
CM 462 RS	E	proprietary	500ms	153K/sec.	32K	Y	Y	Y; multi-session	MS-Bookshelf, PIC-Globe, New Grolier Multimedia Encyclopedia	649	
CM 425 ABK	E	SCSI-2	265ms	300K/sec.	64K	Y	Y	Y; multi-session	none	699	
PLI MS 200	E	SCSI II	200ms	830K/sec.	256K	Y	Y	Y; Both	DiskMestro	external terminator	\$969
Procom Technology PiCDM	I	proprietary	350ms	175K/sec.	32K	Y	Y	Y; Both	Procom Pro CD-ROM drivers	dust free enclosure, plays 8cm or 12cm discs	\$285
PiCDL	I	proprietary	375ms	150K/sec.	32K	Y	Y	Y; single	—	caddy not required	305
PxCDM	E	proprietary	350ms	175K/sec.	32K	Y	Y	Y; Both	Procom Pro CD-ROM drivers	dust free enclosure, plays 8cm or 12cm discs	315
PiCDS	I	proprietary	490ms	150K/sec.	64K	Y	—	Y; multi-session	—	caddy not required	325
PxCDL	E	proprietary	375ms	150K/sec.	32K	Y	Y	Y; single	—	caddy not required	355
PxCDS	E	proprietary	490ms	150K/sec.	64K	Y	—	Y; multi-session	—	caddy not required	375
SiCDS	I	SCSI	380ms	150K/sec.	64K	Y	Y	Y	—	—	565
SiCD-DS	I	SCSI	200ms	330K/sec.	256K	Y	Y	Y	Y; single	—	645
MCD-DS	E	SCSI	200ms	330K/sec.	256K	Y	Y	Y	Y; single	—	725

COMPARISON CHART: CD-ROM DRIVES

Make/Model	* Mounting	Adapter Card Incl.	Access Time (ms)	Data Transfer Rate	Transfer Buffer Size	MPC Compatible	Works w/ Audio CD's	Photo-CD Compat.; Single/Multi-Sessions	Software Included	Other Features	Price
CD Tower4-DS	E	SCSI-2	200ms	330K/sec.	—	Y	Y	Y; Both	drivers for DOS, Windows, NetWare 3.11 & 4.0	external four-CD drive tower, dust-proof door	2,795
Sony CDU-31A	I	—	550ms	150K/sec.	—	—	—	—	GeoWorks CD-ROM Manager, TEMPRA	16-bit MediaVision sound board	\$379
CDU-31ALL/N	I	Y	550ms	150K/sec.	—	—	—	—	GeoWorks CD-ROM Manager, TEMPRA, Desktop Library	16-bit MediaVision sound board, cable	499
Tandy/Radio Shack Tandy CDR-1100	I	serial XT/AT bus	375ms	153.6K/sec.	32K	Y	Y	N; single	installation, Windows drivers	direct loading- no caddy required	\$399
Tandy CDR-3100	E	serial XT/AT bus	375ms	153.6K/sec.	32K	Y	Y	N; single	installation, Windows drivers	direct loading- no caddy required	499
Texel DM-3024	I	T-130 (SCSI-2)	265ms	300K/sec.	64K	Y	Y	Y; Both	opt.	self-cleaning lens mechanism	\$499/599
DM-5024	E	T-130 (SCSI-2)	265ms	300K/sec.	64K	Y	Y	Y; Both	opt.	self-cleaning lens mechanism	599/699
Toshiba XM-3410B	I	SCSI-2	200ms	330K/sec.	256K	Y	Y	Y;—	opt.	self-cleaning lens mechanism	\$695
TXM-3401E	E	SCSI-2	200ms	330K/sec.	256K	Y	Y	Y;—	opt.	self-cleaning lens mechanism	895
TXM-3401P	E	SCSI-2	200ms	330K/sec.	256K	Y	Y	Y;—	opt.	portable	925
CD-ROM DRIVE MANUFACTURERS											
Acculogic, Inc.	Hitachi Home Electronics (America), Inc.										
13715 Alton Pkwy., Irvine, CA 92718, (714) 454-2441	43 Riviera Dr., Markham, Ontario, CN L3R 5J6, (416) 475-1077										
CD Technology, Inc.	Liberty Systems, Inc.										
766 San Aleso Ave., Sunnyvale, CA 94086, (408) 752-8500	160 Saratoga Ave., Ste. 38, Santa Clara, CA 95051, (408) 983-1127										
Chinon America Inc.	Introl Corp.										
615 Hawaii Ave., Tornace, CA 90503, (310) 533-0274	2817 Anthony Lane S., Minneapolis, MN 55418, (612) 788-9391										
Laser Magnetic Storage International Co.	Peripheral Land Inc.										
4425 ArrowWest Dr., Colorado Springs, CO 80907, (719) 593-7900	47421 Bayside Pkwy., Fremont, CA 94538, (510) 657-2211										
Philips Consumer Electronics Company	Legacy Storage Systems, Inc.										
1 Philips Drive P.O. Box 14810, Knoxville, TN 37914-1810, (800) 835-3506	43 Riviera Dr., Markham, Ontario, CN L3R 5J6, (416) 475-1077										
Procom Technology	PLI: see Peripheral Land Inc.										
2181 Dupont Dr., Irvine, CA 92715, (714) 852-1000	Peripheral Land Inc.										
Sony Computer Peripheral Products Co.	94538, (510) 657-2211										
655 River Oaks Pkwy., San Jose, CA 95134, (800) 352-7669	9740 Irvine Blvd., Irvine, CA 92718, (714) 583-3000										
Tandy Corp./Radio Shack	Toshiba America Information Systems, Inc.										
1500 One Tandy Ctr., Fort Worth, TX 76102, (817) 390-3011	4255 Burton Dr., Santa Clara, CA 95054, (408) 980-1838										
Texel	Toshiba America Information Systems, Inc.										

HARD DISK DRIVES

MAKE/ MODEL	CAPACITY (Mb)	SPEED (ms)	CONTROLLER	STREET PRICE	DEALER	MAKE/ MODEL	CAPACITY (Mb)	SPEED (ms)	CONTROLLER	STREET PRICE	DEALER
IDE											
Conner						Maxtor					
CP3000	40	28	N	\$125	R & R Electronics	7213A	210	15	N	\$224	DC Drives
CP3000	40	28	N	125	Shecom Computers	7213A	210	15	N	225	Tribeca
CP3000	40	25	N	129	MicroMax	7213A	210	15	N	236	Computer Products Corp.
CP3000	40	25	Y	175	Computer Products Corp.	7213A	210	15	N	245	Hard Drives Unlimited
CP30084	80	17	N	160	S.A.G. Electronics	7213A	210	15	N	259	Insight
CP30084	80	19	N	179	MicroMax	Western Digital					
CP30084	80	19	N	195	Hard Drives Unlimited	2200A	210	13	N	213	DC Drives
Western Digital						2200A	210	14	N	215	Storage USA
WD280A	80	15	N	199	Insight	2200A	210	12	N	238	Hard Drives Unlimited
Seagate						2200A	210	12	N	253	SoftHard Systems
ST3120A	105	15	N	169	S.A.G. Electronics	2200A	210	12	N	269	USA Flex
ST3120A	105	12	N	185	Hard Drives Unlimited	Maxtor					
ST3120A	105	15	N	209	Harmony Computers	7245A	240	15	N	232	S.A.G. Electronics
Conner						7245A	240	15	N	250	Tribeca
CP30104	120	19	N	169	Storage USA	7245A	240	15	N	269	Nevada Computer
CP30104	120	18	Y	199	DC Drives	7245A	240	15	N	269	SoftHard Systems
CP30104	120	19	N	204	Hard Drives Unlimited	7245A	240	15	N	283	Hard Drives Unlimited
Maxtor						Quantum					
7120A	130	15	N	190	R & R Electronics	LPS240A	240	16	N	195	Tribeca
7120A	130	15	N	190	Shecom Computers	LPS240A	240	16	N	266	DC Drives
7120A	130	15	Y	245	DC Drives	LPS240A	240	16	N	289	Storage USA
XT7130A	130	15	N	213	Hard Drives Unlimited	LPS240A	240	16	N	305	HD Computer
Seagate						LPS240A	240	16	N	347	SoftHard Systems
ST3144A	130	16	N	169	S.A.G. Electronics	LPS240A	240	9	N	359	Insight
ST3144A	130	16	N	196	MicroDyne Computer	Seagate					
ST3144A	130	16	N	198	Nevada Computer	ST3283A	240	12	N	276	S.A.G. Electronics
ST3144A	130	14	N	199	Hard Drives Unlimited	ST3283A	240	12	N	280	Tribeca
Conner						ST3283A	240	15	N	319	Hard Drives Unlimited
CP30170	170	17	N	189	Treasure Chest	ST3283A	240	12	N	319	Insight
CP30170	170	17	N	229	MegaHaus	ST3283A	240	12	N	319	USA Flex
CP30174	170	17	N	199	DC Drives	ST3283A	240	12	N	359.95	TriState Computer
CP30174	170	17	N	208	Aberdeen	Western Digital					
CP30174	170	17	N	213	S.A.G. Electronics	WD2240	240	14	N	242	S.A.G. Electronics
CP30174	170	17	N	228	Hard Drives Unlimited	Conner					
Maxtor						CP30254	250	14	N	250	S.A.G. Electronics
7170A	170	15	N	229	Hard Drives Unlimited	CP30254	250	14	N	290	Hard Drives Unlimited
Western Digital						CP30254	250	12	N	298	Nevada Computer
1170	170	15	N	229	Hard Drives Unlimited	Western Digital					
1170	170	11	N	264	MicroMax	2250A	250	12	N	239	Insight
2170	170	12	N	233	SoftHard Systems	2250A	250	12	N	285	SoftHard Systems
2170	170	11	N	264	MicroMax	2250A	250	14	N	290	Hard Drives Unlimited
<i>For dealer addresses and phone numbers see page 88 NA denotes not available</i>											

STREET PRICE GUIDE: HARD DISK DRIVES

MAKE/ MODEL	CAPACITY (Mb)	SPEED (ms)	CONTROLLER	STREET PRICE	DEALER	MAKE/ MODEL	CAPACITY (Mb)	SPEED (ms)	CONTROLLER	STREET PRICE	DEALER
Seagate						CP30200	200	12	N	\$299	MegaHaus
ST3385A	340	12	N	\$379	MicroDyne Computer	CP30200	210	12	N	265.95	Lyco Computer
ST3385A	340	12	N	380	Tribeca	CP30200	210	12	N	309	Hard Drives Unlimited
Western Digital						Maxtor					
2340	340	13	N	303	S.A.G. Electronics	7213S	210	15	N	242	Computer Products Corp.
2340	340	12	N	355	Hard Drives Unlimited	7213S	210	15	Y	250	S.A.G. Electronics
2340	340	12	N	357	SoftHard Systems	7213S	210	15	Y	259	Insight
2340	340	12	N	379	USA Flex	7213S	210	15	N	260	Tribeca
Fujitsu						7213S	210	15	N	286	Hard Drives Unlimited
2623	420	12	N	738	Nevada Computer	7213S	210	15	Y	309	MegaHaus
2623	420	12	N	799	Hard Drives Unlimited	7245S	240	15	N	295	Hard Drives Unlimited
Quantum						Quantum					
PD425A	420	13	N	750	SoftHard Systems	LPS240S	240	16	N	269	DC Drives
Seagate						LPS240S	240	16	N	283	S.A.G. Electronics
ST1480A	420	14	N	725	Tribeca	LPS240S	240	16	N	295	Tribeca
ST1480A	420	14	N	819.37	Computer Disc. Whse.	LPS240S	240	16	N	299	Storage USA
Western Digital						LPS240S	240	16	N	366	SoftHard Systems
2420	460	13	N	465	Tribeca	Seagate					
Fujitsu						ST3283N	240	12	N	292	S.A.G. Electronics
M2624T	520	12	N	661	V.I.P. Data Systems	ST3283N	240	12	N	319	USA Flex
M2624T	520	12	N	695	Tribeca Computer	ST3283N	240	12	N	369	Hard Drives Unlimited
M2624T	520	12	N	696	DC Drives	ST3283N	240	12	Y	468	Computer Products Corp.
M2624T	520	12	Y	714	DC Drives	Maxtor					
M2624T	520	12	N	735	SoftHard Systems	7345S	340	15	N	399	Hard Drives Unlimited
M2624T	520	12	N	799	Hard Drives Unlimited	7345S	340	15	N	399	MegaHaus
Quantum						7345S	340	15	N	399	SoftHard Systems
LPS525A	520	10	N	650	Tribeca	7345S	340	15	Y	449	MegaHaus
Seagate						Fujitsu					
ST3600A	520	11	N	825	Tribeca	2623	420	12	N	660	S.A.G. Electronics
Maxtor						2623	420	11	N	829	Hard Drives Unlimited
LXT535A	530	12	N	750	Tribeca	2623	420	12	N	895	Network Express
Conner						Quantum					
CP30544	540	10	N	639	Storage USA	PD425S	420	13	N	789	SoftHard Systems
CP30544	540	12	N	695	Hard Drives Unlimited	Fujitsu					
CP30544	540	12	Y	999	Insight	2624	520	12	N	678	S.A.G. Electronics
Maxtor						2624	520	12	N	685	SoftHard Systems
MXT540A	540	9	N	835	SoftHard Systems	2624	520	12	N	695	Tribeca
Micropolis						2624	520	12	N	699	DC Drives
MC2105A	560	10	N	869	SoftHard Systems	2624	520	12	N	699	Insight
MC2112A	1050	10	N	993	S.A.G. Electronics	2624	520	11	N	849	Hard Drives Unlimited
MC2112A	1050	10	N	999	DC Drives	Quantum					
MC2112A	1050	10	N	999	MegaHaus	LPS525S	520	10	N	650	Tribeca
MC2112A	1050	10	N	1,049	Storage USA	LPS525S	520	10	N	849	SoftHard Systems
MC2112A	1050	10	N	1,149	SoftHard Systems	Seagate					
SCSI						ST3600N	520	11	N	825	Tribeca
Conner						Conner					
CP30800	80	17	N	\$166	S.A.G. Electronics	CP30450	540	12	N	720	Hard Drives Unlimited
CP30800	80	19	Y	316	Computer Products Corp.	Maxtor					
Maxtor						MXT540S	540	9	N	795	Tribeca
7120S	120	15	N	229	Hard Drives Unlimited	MXT540S	540	9	N	835	SoftHard Systems
Conner						MXT540S	540	9	N	959	Maxtor
CP30170	170	17	N	202	S.A.G. Electronics	Micropolis					
CP30170	170	17	N	205	Storage USA	MC2105	560	10	N	799	DC Drives
CP30170	170	17	N	240	Hard Drives Unlimited	MC2105	560	10	Y	829	MegaHaus
CP30200	200	12	N	274	S.A.G. Electronics	MC2105	560	10	N	879	MegaHaus
CP30200	200	12	N	279	Storage USA	MC2105	560	10	N	959	MidWest Computer

STREET PRICE GUIDE: HARD DISK DRIVES

MAKE/ MODEL	CAPACITY (Mb)	SPEED (ms)	CONTROLLER	STREET PRICE	DEALER	MAKE/ MODEL	CAPACITY (Mb)	SPEED (ms)	CONTROLLER	STREET PRICE	DEALER
Seagate ST4767N	660	12	N	\$971	S.A.G. Electronics	Micropolis MC1528	1350	14	N	\$1,199	Insight
Maxtor XT8760S	670	16	N	1,191	Computer ProductsCorp.	MC1908	1380	10	N	1,699	SoftHard Systems
Seagate ST4766N	670	14	N	1,139	Hard Drives Unlimited	Seagate ST41650N ST41650N	1400 1450	15 15	N N	1,169 1,349	Storage USA Insight
Fujitsu M2266SA	1000	14	N	1,079	SoftHard Systems	Maxtor P117S P117S	1500 1500	13 13	N N	1,289 1,398	TC Peripherals Nevada Computer
Hewlett Packard 97558	1000	13	N	1,399	SoftHard Systems	Seagate ST41651	1600	14	N	1,549	Hard Drives Unlimited
Maxtor PO 12S	1000	12	N	999	TC Peripherals	Micropolis MC1548 MC1548	1700 1700	11 14	N N	1,379 1,675	Storage USA DC Drives
PO 12S	1000	13	N	1,088	Nevada Computer	Fujitsu 2652 2652 2652 2652	1750 1750 1750 1750	11 11 11 11	N N N N	1,789 1,888 1,999 2,199	S.A.G. Electronics Nevada Computer Hard Drives Unlimited Insight
Quantum PD1050	1000	10	N	1,025	SoftHard Systems	Hewlett Packard 3009	1800	11	N	2,299	SoftHard Systems
Seagate ST41200N	1000	15	N	1,028	Computer ProductsCorp.	Seagate ST42100 ST42100	1900 1900	13 15	N N	1,699 1,699	SoftHard Systems Vektron Int'l
ST41200N	1000	15	N	1,049	Vektron Int'l	Hewlett Packard 3010 3010 3010	2000 2000 2000	11 11 11	N N N	2,299 2,399 2,500	MegaHaus HardDrives SuperSource SoftHard Systems
ST41200N	1000	15	N	1,074.29	Computer Disc. Whse.	Micropolis MC1924 MC1924 MC1924 MC1924	2000 2000 2000 2000	11 11 11 11	N N N N	2,179 2,199 2,199 2,279	DC Drives MegaHaus SoftHard Systems Nevada Computer
Micropolis MC1598	1030	14	N	1,129	ComputAbility	Fujitsu 2654S 2654S 2654S 2654S 2654S	2060 2060 2060 2060 2060	11 12 12 12 12	N N N N N	1,760 1,899 2,099 2,249 2,349	S.A.G. Electronics MegaHaus SoftHard Systems Hard Drives Unlimited Insight
Fujitsu M2694ESA	1080	10	N	989	MegaHaus	Seagate ST42400N ST42400N ST42400N	2100 2100 2100	10 11 11	N N N	1,998 2,099 2,299	Storage USA SoftHard Systems
M2694ESA	1080	10	Y	1,039	MegaHaus	Hewlett Packard 3010 3010 3010	2000 2000 2000	11 11 11	N N N	2,299 2,399 2,500	Vektron Int'l
M2694ESA	1080	10	N	1,125	SoftHard Systems	Micropolis MC1924 MC1924 MC1924 MC1924	2000 2000 2000 2000	11 11 11 11	N N N N	2,179 2,199 2,199 2,279	DC Drives MegaHaus SoftHard Systems Nevada Computer
M2266SA	1200	14	N	1,124	S.A.G. Electronics	Fujitsu 2654S 2654S 2654S 2654S 2654S	2060 2060 2060 2060 2060	11 12 12 12 12	N N N N N	1,760 1,899 2,099 2,249 2,349	S.A.G. Electronics MegaHaus SoftHard Systems Hard Drives Unlimited Insight
M2266SA	1200	14	N	1,199	Hard Drives Unlimited	Seagate ST42400N ST42400N ST42400N	2100 2100 2100	10 11 11	N N N	1,998 2,099 2,299	Storage USA SoftHard Systems
M2694SA	1200	10	N	1,099	Insight	Hewlett Packard 3010 3010 3010	2000 2000 2000	11 11 11	N N N	2,299 2,399 2,500	MegaHaus HardDrives SuperSource SoftHard Systems
M2694SA	1200	10	N	1,499	Hard Drives Unlimited	Micropolis MC1924 MC1924 MC1924 MC1924	2000 2000 2000 2000	11 11 11 11	N N N N	2,179 2,199 2,199 2,279	DC Drives MegaHaus SoftHard Systems Nevada Computer
Hewlett Packard 2247	1200	10	N	999	MegaHaus	Fujitsu 2654S 2654S 2654S 2654S 2654S	2060 2060 2060 2060 2060	11 12 12 12 12	N N N N N	1,760 1,899 2,099 2,249 2,349	S.A.G. Electronics MegaHaus SoftHard Systems Hard Drives Unlimited Insight
2247	1200	10	N	1,069	HardDrives SuperSource	Seagate ST42400N ST42400N ST42400N	2100 2100 2100	10 11 11	N N N	1,998 2,099 2,299	Storage USA SoftHard Systems
2247	1200	10	N	1,399	SoftHard Systems	Hewlett Packard 3010 3010 3010	2000 2000 2000	11 11 11	N N N	2,299 2,399 2,500	MegaHaus HardDrives SuperSource SoftHard Systems
Maxtor MXT1240	1200	9	N	1,199	SoftHard Systems	Micropolis MC1924 MC1924 MC1924 MC1924	2000 2000 2000 2000	11 11 11 11	N N N N	2,179 2,199 2,199 2,279	DC Drives MegaHaus SoftHard Systems Nevada Computer
MXT1240	1200	9	N	1,239	MegaHaus	Fujitsu 2654S 2654S 2654S 2654S 2654S	2060 2060 2060 2060 2060	11 12 12 12 12	N N N N N	1,760 1,899 2,099 2,249 2,349	S.A.G. Electronics MegaHaus SoftHard Systems Hard Drives Unlimited Insight
MXT1240	1200	9	Y	1,289	MegaHaus	Seagate ST42400N ST42400N ST42400N	2100 2100 2100	10 11 11	N N N	1,998 2,099 2,299	Storage USA SoftHard Systems
MXT1240	1200	9	N	1,299	Vektron Int'l	Hewlett Packard 3010 3010 3010	2000 2000 2000	11 11 11	N N N	2,299 2,399 2,500	MegaHaus HardDrives SuperSource SoftHard Systems
Seagate ST11200N	1200	11	N	993	S.A.G. Electronics	Micropolis MC1924 MC1924 MC1924 MC1924	2000 2000 2000 2000	11 11 11 11	N N N N	2,179 2,199 2,199 2,279	DC Drives MegaHaus SoftHard Systems Nevada Computer
ST11200N	1200	10	N	1,249	Hard Drives Unlimited	Fujitsu 2654S 2654S 2654S 2654S 2654S	2060 2060 2060 2060 2060	11 12 12 12 12	N N N N N	1,760 1,899 2,099 2,249 2,349	S.A.G. Electronics MegaHaus SoftHard Systems Hard Drives Unlimited Insight
Toshiba MK538FB	1200	12	N	979	MegaHaus	Seagate ST42400N ST42400N ST42400N	2100 2100 2100	10 11 11	N N N	1,998 2,099 2,299	Storage USA SoftHard Systems
MK538FB	1200	12	Y	1,109	DC Drives	Hewlett Packard 3010 3010 3010	2000 2000 2000	11 11 11	N N N	2,299 2,399 2,500	MegaHaus HardDrives SuperSource SoftHard Systems
Conner CP31370	1300	10	N	1,449	Network Express	Micropolis MC1924 MC1924 MC1924 MC1924	2000 2000 2000 2000	11 11 11 11	N N N N	2,179 2,199 2,199 2,279	DC Drives MegaHaus SoftHard Systems Nevada Computer
CP31370	1300	10	N	1,879	Cost+Plus	Fujitsu 2654S 2654S 2654S 2654S 2654S	2060 2060 2060 2060 2060	11 12 12 12 12	N N N N N	1,760 1,899 2,099 2,249 2,349	S.A.G. Electronics MegaHaus SoftHard Systems Hard Drives Unlimited Insight
Micropolis MC1528	1300	14	N	969	Storage USA	Seagate ST42400N ST42400N ST42400N	2100 2100 2100	10 11 11	N N N	1,998 2,099 2,299	Storage USA SoftHard Systems
MC1528	1390	14	N	1,199	DC Drives	Hewlett Packard 3010 3010 3010	2000 2000 2000	11 11 11	N N N	2,299 2,399 2,500	MegaHaus HardDrives SuperSource SoftHard Systems
MC1598	1300	14	N	959	Storage USA	Micropolis MC1936 MC1936 MC1936 MC1936	3000 3000 3000 3000	12 11 12 12	N N N N	2,664 2,729 2,799 2,799	S.A.G. Electronics MegaHaus SoftHard Systems Storage USA
MC1598	1300	14	N	1,093	S.A.G. Electronics	Fujitsu 2654S 2654S 2654S 2654S 2654S	2060 2060 2060 2060 2060	12 12 12 12 12	N N N N N	2,664 2,729 2,799 2,799	S.A.G. Electronics MegaHaus SoftHard Systems Storage USA
Seagate ST41600	1300	15	N	1,608	S.A.G. Electronics	Seagate ST42400N ST42400N ST42400N	2100 2100 2100	10 11 11	N N N	1,998 2,099 2,299	Storage USA SoftHard Systems
ST41600	1300	12	N	1,645	Tribeca	Hewlett Packard 3010 3010 3010	2000 2000 2000	11 11 11	N N N	2,299 2,399 2,500	MegaHaus HardDrives SuperSource SoftHard Systems
ST41600	1300	11	N	1,699	SoftHard Systems	Micropolis MC1936 MC1936 MC1936 MC1936	3000 3000 3000 3000	12 11 12 12	N N N N	2,664 2,729 2,799 2,799	S.A.G. Electronics MegaHaus SoftHard Systems Storage USA

FLOPPY DISK DRIVES

MAKE/ MODEL	MOUNT- ING	STREET PRICE	DEALER	MAKE/ MODEL	MOUNT- ING	STREET PRICE	DEALER				
Dual											
Canon	i	\$124	Discount Micro	Toshiba	i	\$59	MidWest Computer Works				
Canon	i	129	Storage USA	Toshiba	i	61	Telemart				
Canon	i	139	Aberdeen	Toshiba	i	69	Arlington Computer				
Canon	i	139	ComputAbility	3.5/2.88Mb							
Teac	i	129	MicroMax	Chinon	i	\$75	MidWest Micro				
Teac	i	129	MidWest Computer Works	Chinon	i	82.95	Lyco Computer				
Teac	i	129	Storage USA	Epson	i	89	Ralin Wholesalers				
Teac	i	129.95	Lyco Computer	Teac	i	85.95	Lyco Computer				
Teac	i	135	Arlington Computer	Teac	i	99	USA Flex				
Teac	i	138	HD Computer	Toshiba	i	72	Discount Micro				
Teac	i	145	Insight	3.5/720K							
Teac	i	149	Aberdeen	Chinon	i	\$51	MidWest Micro				
Teac	i	149	USA Flex	5.25/1.2Mb							
3.5/1.44Mb											
Chinon	i	\$47.95	Lyco Computer	Chinon	i	\$51.95	Lyco Computer				
Chinon	i	51.50	MidWest Micro	Chinon	i	60	MidWest Micro				
Epson	i	46	Discount Micro	Epson	i	52	Discount Micro				
Epson	i	48	HD Computer	Epson	i	53	HD Computer				
Epson	i	50	Fridays Electronics	Epson	i	56	Aberdeen				
Epson	i	52	Aberdeen	Epson	i	58	Fridays Electronics				
Epson	i	59	Ralin Wholesalers	Epson	i	59	Ralin Wholesalers				
Mitsumi	i	41	Storage USA	Mitsumi	i	52	Jade Computer				
Mitsumi	i	42	Amka Computer	Mitsumi	i	46	PC Importers				
Mitsumi	i	42	MicroMax	Mitsumi	i	47	MicroMax				
Mitsumi	i	42	PC Importers	Mitsumi	i	48	Amka Computer				
Mitsumi	i	46	Jade Computer	Mitsumi	i	48	Storage USA				
Mitsumi	i	48	Fridays Electronics	Panasonic	i	55	MidWest Micro				
Panasonic	i	49	MidWest Micro	Samsung	i	49	Insight				
Samsung	i	49	Insight	Teac	i	53	MicroMax				
Sony	i	53	Fridays Electronics	Teac	i	55	Discount Micro				
Sony	i	55	ComputAbility	Teac	i	58	HD Computer				
Sony	i	59	MidWEst Micro	Teac	i	59	Insight				
Teac	i	47	Discount Micro	Teac	i	59	MidWest Computer Works				
Teac	i	48	MicroMax	Teac	i	62	Aberdeen				
Teac	i	53	HD Computer	Teac	i	65	Telemart				
Teac	i	58	Aberdeen	Toshiba	i	59	MidWest Micro				
Teac	i	59	Insight	Toshiba	i	65	Telemart				
Teac	i	59	MidWest Computer Works	5.25/360K							
Teac	i	65	Telemart	Chinon	i	\$45	MidWest Micro				
Toshiba	i	51	MidWest Micro								

I = Internal For dealer addresses and phone numbers see page 88

SOUND BOARDS

MAKE/ MODEL	* COMPATIBLE					BITS	SPEAKERS	STREET PRICE	DEALER	MAKE/ MODEL	* COMPATIBLE					BITS	SPEAKERS	STREET PRICE	DEALER
Aztech Labs																			
Sound Galaxy BX II	Y	8	Y	\$60	CMO					SoundMan 16	Y	16	N	\$99	ComputAbility				
Sound Galaxy BX II	Y	8	Y	69.95	MicroWarehouse					SoundMan 16	Y	16	N	139	Hard Drive Super Source				
Sound Galaxy NX II	Y	8	Y	79	USA Flex					SoundMan 16	Y	16	N	145	Ider				
Sound Galaxy NX Pro16	Y	16	Y	159	CMO					SoundMan 16	Y	16	N	149	Harmony Computers				
Sound Galaxy NX Pro16	Y	16	Y	179	USA Flex					SoundMan 16	Y	16	N	179	CMO				
Sound Galaxy NX Pro16	Y	16	Y	189.95	MicroWarehouse					SoundMan 16	Y	16	N	179.95	MicroWarehouse				
Sound Galaxy NX Pro/MA	Y	16	Y	119	USA Flex					Logitech									
Covox																			
SoundMaster II	Y	16	Y	125	CMO					Fusion CD 16	Y	16	Y	495	USA Flex				
Voice Blaster	Y	8	Y	69	CMO					Fusion CD 16	Y	16	Y	499	CMO				
Creative Labs																			
SoundBlaster	Y	8	N	78	Hard Drive Super Source					Fusion CD 16	Y	16	Y	509	Kenosha Computer				
SoundBlaster 16	Y	16	N	159	ComputAbility					Fusion CD 16	Y	16	Y	529	Insight				
SoundBlaster 16	Y	16	N	159	USA Flex					Pro 16 Multimedia System	Y	16	Y	889	USA Flex				
SoundBlaster 16 ASP	Y	16	N	209	Hard Drive Super Source					Pro AudioSpectrum 16	Y	16	N	155	Discount Micro				
SoundBlaster 16 ASP	Y	16	N	215	ComputAbility					Pro AudioSpectrum 16	Y	16	N	159	Hard Drive Super Source				
SoundBlaster 16 ASP	Y	16	N	219.95	TriState Computer					Pro AudioSpectrum 16	Y	16	N	165	ComputAbility				
SoundBlaster 16 ASP	Y	16	N	229.95	MicroWarehouse					Pro AudioSpectrum 16	Y	16	N	169.95	MicroWarehouse				
SoundBlaster 16 ASP	Y	16	N	231	Midland ComputerMart					Pro AudioSpectrum 16	Y	16	N	174.95	TriState Computer				
SoundBlaster 16 ASP	Y	16	N	265	HD Computer					Pro AudioSpectrum 16	Y	16	N	179	Midland ComputerMart				
SoundBlaster Deluxe	Y	8	N	78	Midland ComputerMart					ProAudio Studio 16	Y	16	N	199	Hard Drive Super Source				
SoundBlaster Deluxe	Y	8	N	80	Discount Micro					ProAudio Studio 16	Y	16	N	200	DC Drives				
SoundBlaster Deluxe	Y	8	N	85	ComputAbility					ProAudio Studio 16	Y	16	N	205	ComputAbility				
SoundBlaster Deluxe	Y	8	N	84.95	TriState Computer					ProAudio Studio 16	Y	16	N	215	USA Flex				
SoundBlaster Pro	Y	16	N	125	Ider					Microsoft									
SoundBlaster Pro	Y	16	N	169	Discount Micro					Windows Sound System	Y	8	N	175	ComputAbility				
SoundBlaster Pro	Y	16	N	169	HD Computer					Windows Sound System	Y	8	N	179.83	Computer Disc. Whse.				
SoundBlaster Pro Deluxe	Y	8	N	125	USA Flex					Windows Sound System	Y	8	N	185	MidWest Computer Work				
SoundBlaster Pro Deluxe	Y	8	N	129	Discount Micro					Windows Sound System	Y	8	N	189	Publishing Perfection				
SoundBlaster Pro Deluxe	Y	8	N	129	Hard Drive Super Source					Orchid									
SoundBlaster Pro Deluxe	Y	8	N	129.95	MicroWarehouse					Sound Producer	Y	8	N	109.43	Computer Disc. Whse.				
SoundBlaster Pro Deluxe	Y	8	N	129.95	TriState Computer					Sound Producer Pro	Y	8	N	109	Hard Drive Super Source				
SoundBlaster Pro MC	Y	16	N	259	Midland ComputerMart					Sound Producer Pro	Y	8	N	165.95	MicroWarehouse				
Turtle Beach																			
MultiSound	Y	16	N	499.95	TriState Computer					MultiSound	Y	16	N	529	ComputAbility				
MultiSound	Y	16	N	529	ComputAbility					MultiSound	Y	16	N	529	Publishing Perfection				
MultiSound	Y	16	N	549.95	MicroWarehouse					MultiSound	Y	16	N	549.95	MicroWarehouse				

For dealer addresses and phone numbers see page 88 * = Sound Blaster Compatible

CD-ROM DRIVES

MAKE/ MODEL	SPEED (ms)	TRANSFER RATE (kb)	* MOUNTING	STREET PRICE	DEALER	MAKE/ MODEL	SPEED (ms)	TRANSFER RATE (kb)	* MOUNTING	STREET PRICE	DEALER
Chinon						Philips					
CDC 435	350	150	e	\$429	Best Computer Supplies	CDR 84-1	280	300	i	\$529.91	Computer Disc. Whse.
CDC 435	350	150	e	479.95	MicroWarehouse	CDR 84-1	280	300	i	529.95	TriState Computer
CDC 435	350	150	i	299	Best Computer Supplies	CDD 462RS	500	150	e	439	USA Flex
CDC 435 Mac	350	150	e	429	Best Computer Supplies	Sony					
CDS 435	350	150	i	299	Storage USA	CDU 31A	550	150	i	218	HiTech USA
CDS 435	350	150	i	319.95	MicroWarehouse	CDU 31A	550	150	i	219	Hard Drive Super Source
CDS 435	350	150	i	375	CMO	CDU 31A	550	150	i	229	Discount Micro
CDS 435	350	150	i	399.95	MicroWarehouse	CDU 31A	550	150	i	233	Computer Disc. Whse.
CDS 535	280	300	e	489	Hard Drive Super Source	CDU 535	340	150	i	279	Computer Disc. Whse.
CDS 535	280	300	e	569.95	MicroWarehouse	CDU 535	340	150	i	345	USA Flex
CDS 535	280	300	i	389	CMO	CDU 541	380	150	i	385	HD Computer
CDS 535	280	300	i	389	Hard Drive Super Source	CDU 541	380	150	i	415	Storage USA
CDS 535	280	300	i	389	Storage USA	CDU 541	380	150	i	418	Computer Disc. Whse.
CDS 535	280	300	i	449.95	MicroWarehouse	CDU 6211M	380	150	e	534	Computer Disc. Whse.
CDX 435	350	150	e	429	Storage USA	CDU 7211	380	150	e	539	Storage USA
CDX 435	350	150	e	489	CMO	Teac					
CDX 435	350	150	e	499.95	MicroWarehouse	CD 50	285	150	i	349	USA Flex
Hitachi						Texel					
CDR 1700	300	150	e	467.42	Computer Disc. Whse.	DM 3024	265	300	e	439	Hard Drive Super Source
CDR 3700	300	150	i	399	MidWest Computer Work	DM 3024	265	300	e	515.08	Computer Disc. Whse.
CDR 3700	300	150	i	409.30	Computer Disc. Whse.	DM 3024	265	300	i	359	Hard Drive Super Source
Mitsumi						DM 3024	265	300	i	368	Hi-Tech USA
CDR 055	350	150	i	175	Storage USA	DM 3024	265	300	i	439.27	Computer Disc. Whse.
CDR 055	350	150	i	189	Hard Drive Super Source	DM 3024	265	300	i	469	Action Multimedia
CDR 055	350	150	i	199	USA Flex	DM 3024	265	300	i	489	USA Flex
NEC						DM 5024	265	300	e	448	Hi-Tech USA
CDR 38	400	150	p	379.40	Computer Disc. Whse.	DM 5024	265	300	e	569	Action Multimedia
CDR 38	400	150	p	469	MidWest Computer Work	DM 5024	265	300	e	579	USA Flex
CDR 74MM	200	150	e	819.32	Computer Disc. Whse.	Toshiba					
CDR 74-1	280	300	e	539	Action Multimedia	3401	200	150	e	575	Action Multimedia
CDR 74-1	280	300	e	549	CMO	3401	200	330	e	539	Hard Drive Super Source
CDR 74-1	280	300	e	589.36	Computer Disc. Whse.	3401	200	330	e	549	USA Flex
CDR 74-1	280	300	e	589.95	TriState Computer	3401	200	330	e	559	Kensha Computer
CDR 74-1	280	300	e	599	USA Flex	3401	200	330	e	575	HD Computer
CDR 84-1	280	300	i	442	Action Multimedia	3401	200	330	i	429	Hard Drive Super Source
CDR 84-1	280	300	i	465	CMO	3401	200	330	i	449	Kensha Computer
CDR 84-1	280	300	i	465	Storage USA	3401	200	330	i	465	Action Multimedia
CDR 84-1	280	300	i	479	Hard Drive Super Source	3401	200	330	i	469	USA Flex
CDR 84-1	280	300	i	499	USA Flex	4301	200	330	i	599	CMO
						4301	200	330	i	489.95	TriState Computer

For dealer addresses and phone numbers see page 88 * i = internal e = external p = portable

MEMORY UPGRADE

TYPE/ CAPACITY	SPEED (ns)	PRICE	DEALER	TYPE/ CAPACITY	SPEED (ns)	PRICE	DEALER
SIMM							
1 x 3	60	\$38	R & R Electronics	1 x 36	70	\$164	MidWest Micro
1 x 3	60	38	Shecom Electronics	4 x 8	70	131	Memory Express
1 x 3	60	41	Nevada Computer	4 x 9	60	150	R & R Electronics
1 x 3	60	44	MidWest Micro	4 x 9	60	150	Shecom Electronics
1 x 3	70	36	H.Co.	4 x 9	60	159	AmRam
1 x 3	70	36	Nevada Computer	4 x 9	60	168	Nevada Computer
1 x 3	70	37	Shecom Electronics	4 x 9	60	178	MidWest Micro
1 x 3	70	39	Memory Express	4 x 9	60	179	L.A. Trade
1 x 3	70	43	MidWest Micro	4 x 9	70	139	Micromax
1 x 3	80	35	Nevada Computer	4 x 9	70	140	Shecom Electronics
1 x 3	80	37	R & R Electronics	4 x 9	70	145	Memory Express
1 x 3	80	37	Shecom Electronics	4 x 9	70	148	Nevada Computer
1 x 3	80	42.50	MidWest Micro	4 x 9	70	150	L.A. Trade
1 x 3	80	37.50	Memory Express	4 x 9	70	159	Access Computer Comp.
1 x 8	80	37.50	MidWest Micro	4 x 9	70	159	MidWest Micro
1 x 9	40	58	Nevada Computer	4 x 9	80	138	Nevada Computer
1 x 9	40	59	L.A. Trade	4 x 9	80	140	R & R Electronics
1 x 9	53	49	Nevada Computer	4 x 9	80	144	Shecom Electronics
1 x 9	53	54	L.A. Trade	4 x 9	80	146	L.A. Trade
1 x 9	53	49	AmRam	4 x 9	80	157	AmRam
1 x 9	60	42	Access Computer Comp.	4 x 9	100	139	Access Computer Comp.
1 x 9	60	43	R & R Electronics	4 x 36	70	599	R & R Electronics
1 x 9	60	43	Shecom Electronics	4 x 36	70	599	Shecom Electronics
1 x 9	60	44	Memory Express	4 x 36	70	657	MidWest Micro
1 x 9	60	44	Nevada Computer	256 x 9	60	10.92	AmRam
1 x 9	60	45	L.A. Trade	256 x 9	60	12	MidWest Micro
1 x 9	70	34	AmRam	256 x 9	60	17	Nevada Computer
1 x 9	70	35	Micromax	256 x 9	60	20	L.A. Trade
1 x 9	70	38	Access Computer Comp.	256 x 9	70	12	Micromax
1 x 9	70	40	Nevada Computer	256 x 9	70	12	Nevada Computer
1 x 9	70	41	L.A. Trade	256 x 9	70	11.50	MidWest Micro
1 x 9	70	42	Memory Express	256 x 9	70	13.95	IDER
1 x 9	70	42	R & R Electronics	256 x 9	70	19	L.A. Trade
1 x 9	70	42	Shecom Electronics	256 x 9	80	9.64	AmRam
1 x 9	80	32	AmRam	256 x 9	80	10	Nevada Computer
1 x 9	80	37	Nevada Computer	256 x 9	80	10.50	MidWest Micro
1 x 9	80	40	Memory Express	256 x 9	80	12	Memory Express
1 x 9	80	40	L.A. Trade	256 x 9	80	18	L.A. Trade
1 x 9	80	42	R & R Electronics	256 x 9	100	6.99	AmRam
1 x 9	80	54	H.Co.	256 x 9	100	9	Nevada Computer
1 x 9	100	34	Nevada Computer	256 x 9	100	17	L.A. Trade
1 x 36	70	159	R & R Electronics	256 x 36	80	44.75	MidWest Micro
1 x 36	70	159	Shecom Electronics				

For dealer addresses and phone numbers see page 88

SOFTWARE

MANUFACTURER/ PRODUCT	STREET PRICE	LIST PRICE	DEALER	MANUFACTURER/ PRODUCT	STREET PRICE	LIST PRICE	DEALER
UTILITY PROGRAMS							
Above Software				DOSFax (DOS)	\$57	\$89	Midland ComputerMart
Above Disc (DOS)	\$59.99	\$79	CompUSA	WinFax Pro (Win)	81	149	Midland ComputerMart
Access Software				WinFax Pro (Win)	89	149	Dustin Discount
Matinee Screen (Win)	29.99	49	CompUSA	Farallon			
AddStor				Timbuktu (Win)	139	199	MicroWarehouse
SuperStor (DOS)	29	99	Software Add Ons	Fifth Generation			
SuperStor (DOS)	47.98	99	CompUSA	Direct Access (D/W)	59	89.95	Dustin Discount
SuperStor (DOS)	69	99	MicroWarehouse	Fifth Generation			
SuperStor Pro (Win)	79.95	149.95	ComputAbility	Direct Access (Win)	59.95	89.95	ComputAbility
SuperStor Pro (DOS)	85	149.95	Insight	Direct Access (DOS)	65	89.95	Software Add Ons
SuperStor Pro (DOS)	87	149.95	MicroWarehouse	DiskLock (DOS)	55.95	79	MicroWarehouse
SuperStor Pro (D/W)	95	149.95	Dustin Discount	DiskLock (D/W)	62.08	79	Computer Discount Whse.
Attitash Software				Disklock (D/W)	54.99	79	CompUSA
WideAngle (Win)	39	59.95	MicroWarehouse	FastBack+ (D/W)	94.95	189.95	ComputAbility
Berkeley Systems				FastBack+ (D/W)	109	189.95	Dustin Discount
AfterDark (Win)	28.95	49.95	ComputAbility	FastBack+ (DOS)	117	189.95	Software Add Ons
AfterDark (Win)	32	49.95	CompuClassics	Pyro (DOS)	34.99	59	CompUSA
AfterDark (Win)	33.99	49.95	Exxus	Funk Software			
StarTrek Screen (Win)	24.95	59.95	MicroWarehouse	Sideways 3.3 (DOS)	35	89.95	Insight
StarTrek Screen (Win)	32.95	59.95	ComputAbility	Sideways 3.3 (DOS)	54.95	89.95	ComputAbility
StarTrek Screen (Win)	45	59.95	Dustin Discount	Sideways 3.3 (DOS)	59	89.95	MicroWarehouse
Caere				Gazelle			
FaxMaster (Win)	71.95	179	ComputAbility	OPTune (DOS)	57	99.95	Software Add Ons
FaxMaster (Win)	77.99	179	CompUSA	OPTune (DOS)	64.99	99.95	CompUSA
FaxMaster (Win)	99	179	Software Add Ons	Gibson Research			
Calera				SpinRite III (DOS)	75.95	129	ComputAbility
FaxGrabber (Win)	64.95	129	ComputAbility	SpinRite III (DOS)	82	129	Software Add Ons
FaxGrabber (Win)	65.95	129	MicroWarehouse	Gold Disk			
FaxGrabber (Win)	95	129	Software Add Ons	ScreenCraze II (Win)	19.99	49.95	CompUSA
Central Point				ScreenCraze II (Win)	25.95	49.95	MicroWarehouse
AntiVirus (DOS)	79.94	129	Computer Disc. Whse.	Helix			
AntiVirus (Win)	85.95	129	ComputAbility	HeadRoom (DOS)	61.95	129	ComputAbility
AntiVirus (DOS)	89.95	129	MicroWarehouse	NetRoom (DOS)	49	79	MicroWarehouse
Copy II PC (DOS)	39	69.96	Software Add Ons	NetRoom (DOS)	59.95	79	ComputAbility
PC Tools (DOS)	119	179	Insight	NetRoom (DOS)	64	79	CompuClassics
PC Tools (DOS)	119.99	179	Exxus	Hewlett Packard			
PC Tools (DOS)	119.95	179	MicroWarehouse	Dashboard (Win)	44.95	99	ComputAbility
Dariana				Dashboard (Win)	45	99	MicroWarehouse
System Sleuth Pro (DOS)	99.99	149	CompUSA	Dashboard (Win)	49	99	CompuClassics
WinSleuth Gold (Win)	78.99	149	CompUSA	Dashboard (Win)	49	99	Dustin Discount
WinSleuth Gold (Win)	89.95	149	ComputAbility	NewWave (Win)	75.95	195	MicroWarehouse
WinSleuth Gold (Win)	95	149	Software Add Ons	NewWave (DOS)	80.95	195	ComputAbility
Delrina				NewWave (Win)	109	195	Publishing Perfection
DOSFax (DOS)	49.25	89	Computer Disc. Whse.	ICOM Simulations			
DOSFax (DOS)	49	89	Software Add Ons	Intermission (Win)	27.99	39.95	CompUSA

For dealer addresses and phone numbers see page 88

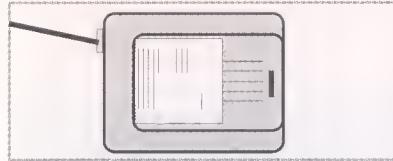
STREET PRICE GUIDE: SOFTWARE

MANUFACTURER/ PRODUCT	STREET PRICE	LIST PRICE	DEALER	MANUFACTURER/ PRODUCT	STREET PRICE	LIST PRICE	DEALER
Intermission (Win)	\$29	\$39.95	MicroWarehouse	SofNet			
Intel				FaxWorks (DOS)	\$42.95	\$79	ComputAbility
Faxibility (DOS)	29	79	Harmony Computers	FaxWorks (Win)	44.99	79	CompUSA
Faxibility+ (Win)	51.65	79	Computer Discount Whse.	SoftLogic Solutions			
Laser Tools				Disk Optimizer (DOS)	32	69.95	Software Add Ons
PrintCache (DOS)	42.95	129	ComputAbility	Disk Optimizer (DOS)	34.99	69.95	CompUSA
PrintCache (DOS)	49	129	CompuClassics	Software Directions			
PrintCache (DOS)	95	129	Software Add Ons	PrintQ (DOS)	86.95	149	ComputAbility
Lotus Development				PrintQ (DOS)	92	149	Software Add Ons
Improv (DOS)	94.95	179	ComputAbility	Stac Electronics			
Improv (Win)	95	179	Software Add Ons	Stacker (DOS)	89.99	149	Exxus
Improv (DOS)	99	179	Dell	Stacker (DOS)	95	149	Software Add Ons
Magee				Stacker (D/W)	99	149	Dustin Discount
Automenu (DOS)	36.99	59	CompUSA	Stairway Software			
Automenu (DOS)	37.18	59	Computer Discount Whse.	Screen Extender (DOS)	58.99	79	CompUSA
Automenu (DOS)	39	59	Software Add Ons	Screen Extender (DOS)	59.95	79	ComputAbility
Micah Development				Storage Dimensions			
Full Armor (DOS)	55.95	89	MicroWarehouse	SpeedStor (DOS)	37.98	89	CompUSA
Full Armor (DOS)	59	89	Dustin Discount	Symantec			
MicroCom				GrandView (DOS)	82.95	129	Computer Discount Whse.
Virex PC (DOS)	69	129	Dustin Discount	Norton AntiVirus (D/W)	82.95	129	ComputAbility
MoonValley Software				Norton AntiVirus (DOS)	99	129	Insight
Icon Do It (Win)	19.99	39.95	CompUSA	Norton Antivirus (DOS)	82.95	129	Computer Discount Whse.
Icon Do It (Win)	25	39.95	Software Add Ons	Norton			
Parsons Technology				Norton Backup (D/W)	94.95	129	ComputAbility
ViruCide+ (DOS)	29.98	49	CompUSA	Norton Backup (D/W)	95	129	Dustin Discount
Personics				Norton Backup (DOS)	99	129	Midland ComputerMart
Laptop Ultravision (DOS)	59.95	89	ComputAbility	Norton Desktop (DOS)	85	149	CompuClassics
Laptop Ultravision (DOS)	60.23	89	Computer Discount Whse.	Norton Desktop (DOS)	99	149	Insight
Laptop Ultravision (DOS)	64.99	89	CompUSA	Norton Desktop (Win)	109	149	Insight
Polaris				Norton Desktop (D/W)	111.95	149	ComputAbility
PackRat (DOS)	224.91	395	Computer Discount Whse.	Norton Utilities			
PackRat (DOS)	239	395	Software Add Ons	Norton Utilities (DOS)	105	159	CompuClassics
PackRat (Win)	249.95	395	MicroWarehouse	Norton Utilities (DOS)	105	159	Software Add Ons
QMS				Norton Utilities (DOS)	109.99	159	Exxus
UltraScript (DOS)	118	159	Publishing Perfection	Norton Utilities (DOS)	111.95	159	ComputAbility
UltraScript+ (DOS)	259	379	Publishing Perfection	Systems Compatibility			
Qualitas				OutSide In (Win)	58.95	129	ComputAbility
386 Max (DOS)	61	99.95	MicroWarehouse	OutSide In (DOS)	84.99	129	CompUSA
386 Max (DOS)	63	99.95	Software Add Ons	Software Bridge			
386 Max (DOS)	64	99.95	CompuClassics	Software Bridge (DOS)	37.98	99	CompUSA
Quarterdeck				Software Bridge (DOS)	72.95	99	ComputAbility
DesqView 386 (DOS)	127	229.50	Software Add Ons	TouchStone Software			
DesqView 386 (DOS)	129	229.50	MicroWarehouse	Check It (DOS)	77.95	149	ComputAbility
DesqView II (DOS)	59.95	129.95	ComputAbility	Check It (DOS)	79	149	Software Add Ons
DesqView II (DOS)	77	129.95	Software Add Ons	Check It (DOS)	89.99	149	CompUSA
DesqView/X (DOS)	153.45	289	Computer Discount Whse.	Travelling Software			
DesqView/X (DOS)	161.95	289	ComputAbility	Battery Watch (DOS)	32	49.95	Software Add Ons
QEMM 386 (DOS)	59	99.95	Insight	LapLink			
QEMM 386 (DOS)	62	99.95	CompuClassics	LapLink (D/W)	102.95	149	ComputAbility
QEMM 386 (DOS)	69	99.95	Dustin Discount	LapLink (D/W)	105	149	Dell
Revolution Software				LapLink (DOS)	109.95	149	MicroWarehouse
VGA Dimmer (D/W)	35.99	79	CompUSA	XSoft			
Road Scholar				Rooms for Windows (Win)	59	159	MicroWarehouse
Razzle Dazzle (Win)	29.99	49	CompUSA	XTree			
Razzle Dazzle (Win)	30.95	49	ComputAbility	XTree Gold (DOS)	85	149	Insight
				XTree Gold (DOS)	92.95	149	ComputAbility
				XTree Gold (DOS)	99	149	Dustin Discount
				XTree Gold (DOS)	99	149	MicroWarehouse

STREET PRICE GUIDE: DEALERS

DEALERS

A Matter of Fax 65 Worth St., New York, NY 10013, Phone: (800) 521-3FAX, (212) 941-8877	Dee One Systems 1586 Centre Point Dr., Milpitas, CA 95035, Phone: (800) 831-8808, (408) 262-8938	Microcomputer Concepts 15200 Transistor Lane, Huntington Beach, CA 92649, Phone: (800) 772-3914, (714) 898-3002	Storage USA 101 Reighard Ave., Williamsport, PA 17701, Phone: (800) 538-3475, (717) 327-9200
Aberdeen 7801 E. Telegraph Rd., D, Montebello, CA 90640, Phone: (800) 552-6868, (213) 725-3368	Dell Computer Corp. 9505 Arboretum Blvd., Austin, TX 78759-7299, Phone: (800) 545-6095	Micromax 4542 Emery Industrial Pkwy., Cleve- land, OH 44128, Phone: (800) 795- 6299, (216) 464-6533	S.A.G. Electronics 1506 Gorham St., Ste. 207, Lowell, MA 01852, Phone: (800) 989-3475
Action Multimedia PO Box 5004, Fremont, CA 94537- 5004, Phone: (800) 82-CDROM	Discount Micro 3430 E. 7800 S., #107, Salt Lake City, UT 84121, Phone: (800) 574-3325, (801) 562-4411	MidWest Computer Works 180 Lexington Dr., Buffalo Grove, IL 60089, Phone: (800) 869-6757	S&W Computers 31 W. 21st St., New York, NY 10010, Phone: (800) 874-1235, (212) 463-8330
Aero Computers 330 7th Ave., New York, NY 10001, Phone: (800) 232-1050, (212) 971-0276	Dustin Discount 20969 Ventura Blvd., Woodland Hills, CA 91364, Phone: (800) 274-6611, (818) 710-9174	MidWest Micros 6910 US Rte. 36 East, Fletcher, OH 45326, Phone: (800) 572-8844, (513) 368-2650	TC Computers (Treasure Chest) 1310 Carroll St., Kenner, LA 70062, Phone: (800) 723-8282, (504) 468-2113
Arlington Computer Products 1970 Carboy, Mt. Prospect, IL 60056, Phone: (800) 548-5105, (708) 228-6333	Exxus 1105 N. Sycamore, Los Angeles, CA 90038, Phone: (800) 557-1000	Midland ComputerMart 8268 Lehigh Ave., Morton Grove, IL 60053, Phone: (800) 407-0700	Telemart 8804 N. 23rd Ave., Phoenix, AZ 85021, Phone: (800) 821-2033
Best Computer Supplies 4980 Longley Ave., Ste. 104, Reno, Ne- vada 89502, Phone: (800) 544-3472	HD Computer 1196 Kern Ave., Sunnyvale, CA 94086, Phone: (800) 347-0493, (408) 720-0493	Network Express 1611 Northgate Blvd., Sarasota, FL 34234, Phone: (800) 333-9899, (813) 359-3343	TriState Computer 160 Broadway, New York, NY 10038, Phone: (800) 433-5199, (212) 349-3134
Bulldog Computer Products 610 Industrial Park Dr., Evans, GA 30809, Phone: (800) 438-6039, (706) 860-7364	Hard Drive Super Source 1202 Kifer Rd., Sunnyvale, CA 94086, Phone: (800) 252-9777	Nevada Computer 684 Wells Road, Boulder City, NV 89005, Phone: (800) 982-2928	Tribeca Products 10 Reuten Dr., Closter, NJ 07624, Phone: (800) 445-6222, (201) 767-0606
CAD Warehouse 1939 E. Aurora Rd., Twinsburg, OH 44087, Phone: (800) 487-0485	Hard Drives Unlimited 8041 Cassna Ave., Gaithersburg, MD 20879, Phone: (301) 417-0361	PC Importers 4530 Emery Industrial Pkwy., Cleveland, OH 44128, Phone: (800) 886-5155	USA Flex 471 Brighton Dr., Bloomingdale, IL 60108, Phone: (800) 444-4900
CAD & Graphics 1301 Evans, San Francisco, CA 94124, Phone: (800) 288-1611, (415) 647-9671	Harmony Computers 1801 Flatbush Ave., Brooklyn, NY 11210, Phone: (800) 441-1144, (718) 692-3232	Printer Plus 1400 Duke St., Alexandria, VA 22314, Phone: (800) 321-5781	United Computer Express 724 7th Ave., New York, NY 10019, Phone: (800) 448-3738, (212) 247-7606
CMO Corporation 101 Reighard Ave., Williamsport, PA 17701, Phone: (800) 233-8950, (717) 327-9200	Hi Tech USA 1562 Centre Point Dr., Milpitas, CA 95035, Phone: (800) 831-2888, (408) 262-8688	Publishing Perfection N88 W. 16444 Main St., Menomonee Falls, WI 53051, Phone: (800) 782-5974, (414) 255-7600	Vektron 2100 N. Hwy. 360, Ste. 1904, Grand Praire, TX 75050, Phone: (800) 725-0081, (214) 606-0280
CompUSA 14951 N. Dallas Parkway, Dallas, TX 75240-7570, Phone: (800) CompUSA	IDER 9080 Telstar Ave., #302, El Monte, CA 91731, Phone: (800) 622-IDER, (818) 288-0709	R & R Electronics 6050 McDonough Dr., X, Norcross, GA 30093, Phone: (800) 872-6677, (404) 368-1777	V.I.P. Data 4301 Kalamazoo SE, Grand Rapids, MI 49508, Phone: (800) 352-1150, (616) 281-8908
CompuClassics PO Box 10598, Canoga Park, CA 91309, Phone: (800) 827-1994, (818) 347-7500	Insight Computers 1912 W. 4th St., Tempe, AZ 85281 Phone: (800) 998-8071, (602) 902-1176	Ralin Wholesalers PO Box 450, Orchard Park, NY 14127, Phone: (800) 752-9512	
ComputAbility PO Box 17882, Milwaukee, WI 53217, Phone: (800) 554-9950, (414) 357-8181	Kenosha Computer 2133 91st St., Kenosha, WI 53140, Phone: (800) 255-2989, (414) 697-9595	Shecom Computers 22755 Savi Ranch Pkwy., #G, Yorba Linda, CA 92687, Phone: (800) 366-4433, (800) 872-6677	
Computer Clipboard 8309 Linden Oaks Court, Lorton, VA 22079, Phone: (800) 777-4932	Lyco Computer PO Box 5068, Jersey Shore, PA 17740, Phone: (800) 233-8760, (717) 494-1030	Soft Hard Systems 3316 Sheridan Dr., Amherst, NY 14226, Phone: (800) 999-9531, (716) 834-2125	
Computer Discount Warehouse 2840 Maria, Northbrook, IL 60062, Phone: (800) 726-4CDW, (708) 564- 4900	MicroDyne 1956 University Ave., W, St. Paul, MN 55104, Phone: (612) 646-2683	Software Add Ons 2 Greenwood Square, Ste. 155, Bensalem, PA 19020, Phone: (800) 695- 8088, (215) 639-7110	
Computer Products Corp. 1431 S. Cherryvale Rd., Boulder, CO 80303, Phone: (800) 338-4273	MicroWarehouse 1720 Oak St., Lakewood, NJ 08701- 3014, Phone: (800) 367-7080, (908) 370-0518		



Practical PostScript Applications

Two for the Price of One

This month we offer two useful programs for anyone who needs to import tabular material and keep track of downloaded fonts.

Importing Tables Into Desktop Programs

Although today's desktop publishing programs, such as PageMaker, Ventura and QuarkXpress are quite powerful, they still have difficulty dealing with some situations. One of these is side-turned (landscape) tables such as the one shown in Figure 2. I'm not saying that you can't do these tables in any of these programs, but it's a lot easier if you do them in PostScript and then place them in the document of the desktop publishing program as a graphic element.

Recently, I received a data file from a client (Figure 1) that had to be formatted in landscape mode so that it could be used in a document that was being prepared with Ventura Publisher. The nicest thing about this job is that I didn't have to do any retyping. I could use the data file supplied and easily convert it into a PostScript program.

Here's how you can do it

The first thing you always want to do is make a backup copy of the original

file so if you accidentally mess things up, you can always start all over again. I always back up the file and never use it, but I believe in Murphy's Law and I'm sure the first time I don't back it up, everything that can go wrong will. So take the extra minute and make a backup.

Since we write our PostScript programs as simple text files, you'll need a text editor, not a word processor, although you can use one in a pinch if you have to, just remember to save your files out as ASCII or DOS text files.

If you take a look at the data in Figure 1 and compare it with the end result in Figure 2, you'll see that the basic structure is already there. We do need to eliminate some blank lines that appear above the name of each state, but that's easy to do. Next, use your text editor's search and replace capability to search for hard carriage returns at the end of each line and replace them with a hard carriage return and a left parenthesis. Next search for a hard carriage return and replace it with a hard carriage return and a right parenthesis. This puts parentheses around each line. You'll see why in a minute. So the line:

1981 1982 1983 1984 1985 1987
1988 1989

becomes

(1981 1982 1983 1984 1985 1987
1988 1989)

This table contains a total of 10 columns so we'll have to handle the data for each column independently. The first thing we have to do therefore is isolate the data for each column. We got a hand from the person who supplied the data file because the data for each column was separated from the previous one by three spaces.

So now all we have to do is once again use our text editor's search and replace capability to search for three spaces and replace them with a right parenthesis, a space and a left parenthesis. Here's an example:) (.

Doing that, our previous line becomes:

(1981)(1982)(1983)(1984)(1985)
(1987) (1988) (1989)

Of course, all of the other data in the table also gets isolated and surrounded by parentheses, which is just what we want. Thus, the first line of data for Connecticut becomes:

(I) (3,441) (3,853) (4,399) (3,579)
(3,388) (2,531) (2,239) (2,014)
(2,200)

Believe it or not, by doing these simple search and replace procedures, we have already done more than 50% of the programming required to convert the data file into a PostScript program. The reason is that any text that is going to be printed in PostScript must be in parentheses. If we add the appropriate command to the end of each line of data, we can print it exactly as we want to.

Add the Header and Subroutines

Since our PostScript program is going to be used by a desktop publishing program, we'll need to put a proper PostScript header on it. I keep this header handy as a separate file that can be merged into any file I'm working on with just a few keystrokes. Here's the header that I use:

```
%!PS-Adobe-2.0 EPSF-1.2
%%Title:
%%Creator: Jules H. Gilder
%%CreationDate:
%%BoundingBox:
%%EndComments
```

As I've mentioned in the past, the only lines that are critical and must be included are the PS-Adobe line and the BoundingBox line. The others are optional. Of course, there are some numbers missing from the BoundingBox line and those must be filled in. They represent the coordinates of the lower left-hand corner and the upper right-hand corner of a box that would just fit around everything that is printed by the program. In our program here, that line becomes:

```
%%BoundingBox: 140 98 496 681
```

After the PostScript header, I load in some standard definitions that will be used to center and right justify text and to select fonts to be used for printing. This job also requires that

Table I

State High Risk Pools:

(I) Total Number of Enrollees; (II) Total Premiums Collected; and (III) Total Claims Paid by Calendar Year*

1981	1982	1983	1984	1985	1986	1987	1988	1989
Connecticut								
I 3,441 3,853 4,399 3,579 3,388 2,531 2,239 2,014 2,200								
II 1,441,143 2,182,388 3,134,889 3,473,145 3,285,762 3,532,941 3,186,476 3,460,377 4,495,872								
III 1,289,025 2,328,194 3,442,223 4,454,451 4,579,461 4,203,833 6,663,081 7,293,434 10,438,000								
Florida								
I - - 49 382 651 1,036 1,562 2,983 5,934								
II - - 23,759 505,798 1,107,581 1,770,171 2,858,173 5,294,446 12,443,960								
III - - 141,430 774,174 1,686,195 3,963,710 8,581,468 17,425,025								
Indiana								
I - 41 2,288 3,510 3,276 2,998 2,610 2,668 3,132								
II - 34,480 2,352,179 6,356,995 7,505,144 7,197,744 5,301,707 5,607,908 6,210,701								
III - - 217,878 6,843,691 9,518,759 11,552,494 11,564,602 9,640,579 10,690,610								
Minnesota								
I 2,918 4,250 6,669 9,158 10,139 11,784 12,300 14,386 18,797								
II 1,305,245 2,325,060 4,082,351 6,413,829 9,492,438 10,772,454 11,407,281 14,197,219 18,459,482								
III 2,852,845 4,514,172 6,981,967 9,761,835 13,324,992 18,913,879 21,893,358 27,098,596 38,373,578								
N. Dakota								
I - 78 245 615 1,017 1,279 1,463 1,551 1,646								
II - 73,408 138,666 455,874 894,701 1,321,991 1,626,970 1,937,903 2,261,638								
III - 103,400 345,918 1,058,694 1,704,988 2,863,886 3,389,229 3,340,441 3,691,487								
Wisconsin								
I 309 977 1,798 1,918 1,919 2,075 2,476 3,760 6,077								
II 127,840 618,216 1,232,352 2,079,996 2,600,586 2,856,286 2,959,861 4,056,671 6,676,614								
III 37,165 1,144,686 2,463,703 3,104,604 3,265,492 3,336,087 3,956,056 5,518,189 9,754,103								

*Table is derived from data appearing in A.K. Tripler, 'Comprehensive Health Insurance for High Risk Individuals in Communicating for Agriculture, 4th ed., 1990.

Figure 1. — A reduced version of the original table before being given the PostScript treatment. Notice the lack of aligned columns or treatment of the headings.

some text be printed with an underline. While that can be done by first printing the text and then going back and drawing a line under it, a much simpler approach is to simply use a subroutine that automatically underlines each character printed. The routine that I use to do this I call 'showu' and it is an adaptation of an underlining routine that appeared in *Thinking in PostScript* by Glenn C. Reid from Addison-Wesley. Now, anytime I want to print underlined text, I use the **showu** instead of the **show** command.

Based on the dimensions of the page being used in the desktop publishing document that this chart will be used in, I decided that each column in the table would be 58 points (one point is 1/72nd of an inch) wide. With something like this, it's wise to define it as a variable, so that it can be changed later if necessary without the need for you to go through the program and change every instance of the number 58.

This table requires the use of five different typefaces. All are in the Times family but they vary in size

and style. Each of these is defined beforehand so a simple command can be used to switch fonts.

Two more commands are defined next to further simplify coding. The first is the **cr** command which determines the current coordinates of the cursor, assigns them to variables 'x' and 'y' and then moves the cursor down one line and gets ready to print the next line at a new location.

The other variable is something I called 'y_move' because it calculates a value for the y-coordinate and then moves the cursor to the appropriate position. While it looks like I was pretty smart in creating this definition, I must admit that it was an afterthought. The original version of this program contained quite a few lines with the following structure:

```
x # cw mul sub y moveto right
```

where the pound sign (#) is used to represent a digit from 1 to 9. Only after seeing so many of these lines did I go back and set up two 'for' loops to generate the number represented by the # and define the variable 'y_move'.

Program Listing — Aligning a Table for Clean Output

```

%!PS-Adobe-2.0 EPSF-1.2
%%Title: Table 1
%%Creator: Copyright (c) 1993 by Jules H.
Gilder
%%CreationDate: 12:45:00 08-02-93
%%BoundingBox: 140 98 496 681
%%EndComments

/center { dup stringwidth pop 2 div neg 0
rmoveto} bind def
/right {dup stringwidth pop neg 0 rmoveto}
def
/font {findfont exch scalefont setfont} bind def
% SHOWU — use instead of SHOW to
underline text
%
/underlineON {/underline true def} def/Scale
{1000 div 24 mul} bind def
/showu { underlineON underline
{currentpoint moveto gsave currentfont/
FontInfo
known {currentfont/FontInfo get begin 0
UnderlinePosition Scale rmoveto
UnderlineThickness Scale 4 div setlinewidth
end} { 0 -10 rmoveto 0.5
setlinewidth} ifelse dup stringwidth rlineto
stroke grestore show }
{moveto show} ifelse} bind def

/cw 58 def % column width in points

/font1 {10/Times-Bold font} def
/font2 {9/Times-Roman font} def
/font3 {9/Times-Bold font} def
/font4 {8/Times-Roman font} def
/font5 {8/Times-Italic font} def

/cr {currentpoint /y exch def /x exch def 0 y
11 sub moveto} def
/y_move {cw mul sub y moveto right} def

/heads {
/x 565 def
/y 285 def
font3
x y moveto right showu
1 1 8 {/j exch def x j y_move showu} for
} def

/oneline {
currentpoint /y exch def pop /x 571 def
x y moveto right show
1 1 8 {/j exch def x j y_move show} for
0 y moveto show cr
} def

} def

/dollar {/n exch def currentpoint /y exch def
/x exch def
n 5 sub
{65.5 x add 9 n sub cw mul add y moveto
($) show /x x cw add def} repeat
5 {61.5 x add 9 n sub cw mul add y moveto
($) show /x x cw add def} repeat
} def

0 792 translate
-90 rotate

121 153 translate

285.5 329 moveto
font1 (Table I) center show

285.5 314 moveto
(State High Risk Pools;) center show

285.5 299 moveto
(I) Total Number of Enrollees; (II) Total
Premiums Collected; and (III)
Total Claims Paid by Calendar Year*) cen-
ter show

(1981) (1982) (1983) (1984) (1985) (1986)
(1987) (1988) (1989) heads

cr font2

(Connecticut) show cr

(I) (3,441) (3,853) (4,399) (3,579) (3,388)
(2,531) (2,239) (2,014)
(2,200) oneline

(II) (1,441,143) (2,182,388) (3,134,889)
(3,473,145) (3,285,762) (3,532,941)
(3,186,476) (3,460,377) (4,495,872) 9 dol-
lar oneline

(III) (1,289,025) (2,328,194) (3,442,223)
(4,454,451) (4,579,461) (4,203,833)
(6,663,081) (7,293,434) (10,438,000) 9
dollar oneline

(Florida) show cr

(I) () () (49) (382) (651) (1,036) (1,562)
(2,983) (5,934) oneline

(II) () () (23,759) (505,798) (1,107,581)

(1,770,171) (2,858,173) (5,294,446)
(12,443,960) 7 dollar oneline

(III) () () (141,430) (774,174) (1,686,195)
(3,963,710) (8,581,468)
(17,425,025) 6 dollar oneline

(Indiana) show cr

(I) () (41) (2,288) (3,510) (3,276) (2,998)
(2,610) (2,668) (3,132) oneline

(II) () (34,480) (2,352,179) (6,356,995)
(7,505,144) (7,197,744) (6,301,707)
(5,607,908) (6,210,701) 8 dollar oneline

(III) () () (217,878) (6,843,691) (9,518,759)
(11,552,494) (11,564,602)
(9,640,579) (10,690,610) 7 dollar oneline

(Minnesota) show cr

(I) (2,918) (4,250) (6,669) (9,158) (10,139)
(11,784) (12,300) (14,386)
(18,797) oneline

(II) (1,305,245) (2,325,060) (4,082,351)
(6,413,829) (9,492,438) (10,772,454)
(11,407,281) (14,197,219) (18,459,482) 9
dollar oneline

(III) (2,852,845) (4,514,172) (6,981,967)
(9,761,835) (13,324,992) (18,913,879)
(21,893,358) (27,098,596) (38,373,578) 9
dollar oneline

(N. Dakota) show cr

(I) () (78) (245) (615) (1,017) (1,279) (1,463)
(1,551) (1,646) oneline

(II) () (73,408) (138,666) (455,874) (894,701)
(1,321,991) (1,626,970)
(1,937,903) (2,261,638) 8 dollar oneline

(III) () (103,400) (345,918) (1,058,694)
(1,704,988) (2,863,886) (3,389,229)
(3,340,441) (3,691,487) 8 dollar oneline

(Wisconsin) show cr

(I) (309) (977) (1,798) (1,918) (1,919) (2,075)
(2,476) (3,760) (6,077) oneline

```

(continued on next page)

Program Listing (continued)

Table Alignment

```

(II) (127,840) (618,216) (1,232,352)
(2,079,996) (2,600,586) (2,856,286)
(2,959,861) (4,056,671) (6,676,614) 9 dollar oneline

(III) (37,165) (1,144,686) (2,463,703)
(3,104,604) (3,265,492) (3,336,087)
(3,956,056) (5,518,189) (9,754,103) 9 dollar oneline

0.5 setlinewidth 50 0 rlineto stroke
font4
0 0 moveto

(*Table is derived from data appearing in
A.K. Tripler, "Comprehensive Health
Insurance for High Risk Individuals" in )

font5(Communicating for Agriculture,)show
font4 ( 4th ed., 1990.) show

showpage

```

Getting Down to the Nitty Gritty

Well, we've finally finished all of the preliminary stuff. Now it's time to design the three core routines that will convert our data file into a nicely formatted page. Earlier, I said that if we add the appropriate command to the end of each line, that we could get the data to print out exactly as we want it. So let's start with the column headings, which in this case are the years 1981 to 1989. These have to be displayed in underlined bold text, with the first column getting no heading.

Before we go further, let me remind you that PostScript is what is known as a stack-oriented language. This means that the last piece of data is always the one that's available first. Bearing this in mind, and since we already received the data (column heads) in their correct order, we'll have to set up our column heading routine so that it prints the last col-

umn heading first and then works its way to the left.

I've called the column heading printing routine 'heads' for convenience. The first thing this routine does is define the x and y coordinates for the starting point (the end of the row). Then a 9-point bold font is selected for use and the first (really the last) heading is printed and underlined (1989). The remaining eight column headings are printed inside a 'for' loop which moves the x-coordinate one column to the left for each pass.

Here's a little challenge for you. Solve it and we'll give you a little free publicity by printing your solution in an upcoming column. How would you modify the program so that all nine columns could be printed out in the 'for' loop? (Here's a hint. The number zero plays an important part.)

The column headings are one type of columnar data needed for this document. The second is the actual numbers themselves. I've written a different, although similar routine to handle them. It's called 'oneline' and the main difference between it and 'heads' is in the way the x and y coordinates are determined and in the fact that it doesn't underline text that it prints.

The first thing 'oneline' does when it's called into action is to get the current location of the cursor. It saves the y-value, throws away (via the 'pop' command) the x-value and permanently defines x as 571 points. It then prints out the value in the last column and works its way back to the first column.

By the way, looking at the original file you'll notice that some lines, such as those for Florida, don't have any entries for columns 2, 3 and sometimes 4. The data file had hyphens in those spaces. You can leave them in or remove them as I did. If you do the (-) element you created

when you did the search and replaces earlier will just be (), two parentheses with nothing in between them.

The 'oneline' solution is fine for all the lines labelled with the Roman numeral I, but is not the complete solution for those lines labelled with Roman numerals II and III. The reason: the numbers in these lines represent dollars and thus a dollar sign must be added to them. The routine that handles this is, not surprisingly, called 'dollar'.

While writing a routine to put dollar signs in is simple, a look at the data in the table showed me that I could make the table more pleasing to the eye. Normally, since the highest dollar amount is in the tens of millions, the dollar sign would appear in all numbers in the position immediately preceding the 10 millions column. That would mean that for more than half the table, there'd be an excessive amount of white space. So I decided that for the years 1981 to 1984, where no dollar figure ever spilled over into the 10 millions column, that I'd place the dollar sign immediately before the millions column. For the remainder of the table, it would be placed before the 10 millions column. As a result, the 'dollar' subroutine is broken into two nearly identical parts. The first provides four points less space between the dollar sign and the first digit of the number. Even if you look at the final table carefully, you'd be hard pressed to recognize this subtle difference, but it makes the data look much better. By the way, the number that precedes the dollar routine when it is in use tells the routine how many dollar signs are going to be printed on that particular line.

The remainder of the program does the actual printing of the table using all of the subroutines I have just described. As you can see, the actual PostScript program code is quite short.

Table I
State High Risk Pools:

(I) Total Number of Enrollees; (II) Total Premiums Collected; and (III) Total Claims Paid by Calendar Year*								
	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>
Connecticut								
I	3,441	3,853	4,399	3,579	3,388	2,531	2,239	2,014
II	\$1,441,143	\$2,182,388	\$3,134,889	\$3,473,145	\$3,285,762	\$3,532,941	\$3,186,476	\$3,460,377
III	\$1,289,025	\$2,328,194	\$3,442,223	\$4,454,451	\$4,579,461	\$4,203,833	\$6,663,081	\$7,293,434
Florida								
I								
II								
III								
Indiana								
I								
II								
III								
Minnesota								
I	41	2,288	3,510	3,276	2,998	2,610	2,668	3,132
II	\$34,480	\$2,352,179	\$6,356,995	\$7,505,144	\$7,197,744	\$6,301,707	\$5,607,908	\$6,210,701
III		\$217,878	\$6,843,691	\$9,518,759	\$11,552,494	\$11,564,602	\$9,640,579	\$10,690,610
N. Dakota								
I	2,918	4,250	6,669	9,158	10,139	11,784	12,300	14,386
II	\$1,305,245	\$2,325,060	\$4,082,351	\$6,413,829	\$9,492,438	\$10,772,454	\$11,407,281	\$14,197,219
III	\$2,852,845	\$4,514,172	\$6,981,967	\$9,761,835	\$13,324,992	\$18,913,879	\$21,893,358	\$27,098,596
Wisconsin								
I								
II								
III								

*Table is derived from data appearing in A.K. Tripler, "Comprehensive Health Insurance for High Risk Individuals" in *Communicating for Agriculture*, 4th ed., 1990.

Figure 2. — The finished product. The table can now be printed out as is or placed into any desktop publishing program document as a graphic element.

The bulk of the listing is just the original data in a slightly modified form.



Keep Track of the Fonts in Your PostScript Printer With This Handy Utility Program

Did you ever print out a PostScript or desktop publishing document only to find out that some of the text was displayed either as Courier or as the desktop publishing program's crude attempt to simulate your font with a bitmapped image font? Do you frequently use more than one PostScript printer? Are you so busy that you've forgotten whether you've downloaded the fonts your document needs? Was your printer reset since the last time you downloaded PostScript fonts to it?

If any of these questions remind you of situations you've encountered, then you need this handy utility program called FONDIR.PS. Yes, it's true that your printer will probably print out a page showing all the fonts in your printer at power up time, but that doesn't help you if you have soft fonts downloaded later on.

The key to the success of this program is a very useful interactive PostScript command called **forall**. This particular PostScript command can be used to examine the contents of any PostScript dictionary. A dictionary is one of the main data structures used by the PostScript language. The dictionary that we're interested in examining is the one called **FontDirectory**. In our program, we create a data array which we call **FontArray**, where information we retrieve from the **FontDirectory** is stored.

Contrary to what you might believe, the names of the fonts stored in the printer are stored as integer numbers and not as alphabetic characters. Therefore, as we retrieve the data

Font Directory

```

AvantGarde-Book
AvantGarde-BookOblique
AvantGarde-Demi
AvantGarde-DemiOblique
Bookman-Demi
Bookman-Demitalic
Bookman-Light
Bookman-LightItalic
Courier
Courier-Bold
Courier-BoldOblique
Courier-Oblique
Helvetica
Helvetica-Bold
Helvetica-BoldOblique
Helvetica-Condensed
Helvetica-Condensed-Bold
Helvetica-Condensed-BoldOblique
Helvetica-Condensed-Oblique
Helvetica-Narrow
Helvetica-Narrow-Bold
Helvetica-Narrow-BoldOblique
Helvetica-Narrow-Oblique
Helvetica-Oblique
NewCenturySchlbk-Bold
NewCenturySchlbk-BoldItalic
NewCenturySchlbk-Italic
NewCenturySchlbk-Roman
Palatino-Bold
Palatino-BoldItalic
Palatino-Italic
Palatino-Roman
Symbol
Times-Bold
Times-BoldItalic
Times-Italic
Times-Roman
ZapfChancery-MediumItalic
ZapfDingbats

```

39 fonts available.

Remaining usable memory: 2525488 bytes.

from the **FontDirectory**, we must convert it to a string (text) before we store it in **FontArray**. Font names are never longer than 128 characters, hence that number was used to reserve the amount of temporary string space we'd need for each name.

For some strange reason, the font names that are stored in **FontDirectory** are not in any alphabetical order, so when we finally do retrieve them and store them in **FontArray**, they comprise one very confusing list. This list is almost useless because it takes forever to check and see if a particular font is present. It would be much more useful if the list were sorted.

Program Listing — Font Directory

```

/font {findfont exch scalefont
setfont} bind def
/sort {/a exch def /b a length 1 sub
def b -1 1 {/c exch def 0 1 c 1 sub {
/d exch def /e a d get def /f a d 1 add
get def e f gt {a d f put a d
1 add e put} if } for } def %
This is a bubblesort routine. To use
% type "name of array" and "sort"
--- Arrayname sort
/scratch 128 string def

```

```

/FontArray [FontDirectory {pop 128
string cvs} forall] def
FontArray sort

```

```

18/Times-Bold font 40 740 moveto
(Font Directory) show

```

```

11/Times-Roman font 40 710
moveto
currentpoint /h exch def /w exch def
w /x exch def h /y exch def
/shw {show y 12 sub /y exch def
y 40 le {346 /x exch def h /y exch
def} if
x y moveto} def

```

```

FontArray {scratch cvs shw} bind
forall
() {dup length 6 sub 6 exch
getinterval shw} scratch
filenameforall

```

```

/y y 20 sub def x y moveto
FontArray length scratch cvs show (
fonts available.) show

```

```

/y y 20 sub def x y moveto (Remaining
usable memory: ) show
vmstatus dup 3 -1 roll sub scratch
cvs show pop ( bytes.) show pop

```

showpage

Since PostScript is a full blown programming language, writing a sort is not difficult. The routine labelled 'sort' is a slight modification of a Bubble Sort routine included in a very useful book by Ross Smith called *Learning PostScript: A Visual Approach*, published by Peachpit Press. Using it is easy — just type the name of the array to be sorted, followed by the command *sort*.

Because a printer can hold more than 60 fonts, I created a command called 'shw' which is used to replace PostScript's standard 'show' command. This routine shows (displays) a line of text (in this case the font name) and then moves to the next

lowest line and gets ready to print another name. It also checks to see if it's within 40 points of the bottom of the page. If it is, it moves back to the top of the page and gets ready to print the next font name at the top of a second column.

Once all of the font names have been printed, we check the length of *FontArray* to see how many entries there are and use that number to inform the reader how many fonts are available for use. Also, we issue the PostScript *vmstatus* command to see what printer memory is available to download additional fonts.

I think you'll find this program to be one of the most useful you have. ■

DOS Debug

(continued from page 16)

Now you can use the file NAME2.
DO NOT USE NAME1 !!

If after checking the first character of the line the program finds that it is not one that is used to mark a line for deletion, then the character is placed into the *DL* register and printed by another function associated with DOS's Interrupt 21. After the character is printed, the character counter is incremented by 1 and a test is made to see if 12 characters have been printed yet. If not, the program loops back and gets the next character on the line and processes. If 12 characters have been printed, then the rest of the line is ignored and a carriage return and line feed are output. The program then loops back to the very beginning to get the first character of the next line and starts the whole process all over again.

Our DEBUG program script ends with a blank line (this is critical — it *must* stay in), the *rcx* command — which tells DEBUG you want to change the contents of the *CX* regis-

ter, 4D — which is the new value placed in the *CX* register, *w* — which tells DEBUG to write the file *STRIPDIR.COM* to the disk drive, and finally *q* — which lets you quit the DEBUG program.

The text file you just typed in should be saved out as *STRIPDIR.SCR* (you can actually use any name you want). The *.SCR* extension reminds me that it's a DEBUG script file. To create the *.COM* file, type in the following line:

DEBUG < *STRIPDIR.SCR*

This assumes that your copy of DEBUG is stored in a directory that is listed in your path statement. The above command will run the DEBUG program, feed it the *STRIPDIR.SCR* script file and assemble the *STRIPDIR.COM* machine language program and save it out to disk.

To use the *STRIPDIR.COM* program, you need to use DOS's redirection capabilities. An example is

Thinking of buying a laser printer?

You can't try them all before you buy,

but you *can* get all the information you need to make an informed buying choice.

PRINTERS

BUYER'S GUIDE AND HANDBOOK

The only advisor you'll need to get the printer you want.

On sale **NOW**
at book stores and newsstands everywhere.

Also covers dot matrix, inkjets, thermals, and portables.

shown below. It assumes that a DOS directory listing is saved out in a file called *DIRLIST* and that the final list of files will be in a file called *FILELIST*. Here's how you use it:

STRIPDIR < *DIRLIST* >
FILELIST

That's all there is to it. I hope you find the program useful. ■

TONER

Cartridges
Remanufactured

Over 1000
Models

\$44

- Visa, MC, Amax
- ALL MAJOR BRANDS!
- 100% Money Back Guarantee
- FREE DELIVERY, Fast Turnaround
- "Super Drum" Cartridges Available
- Full Line Of DISCOUNTED SUPPLIES



Laser Renew of CT
1-800-347-4221
55 Carmen Hill Road #1
New Milford, CT 06776-4509

80486DX2-66 Power Board! \$175

VESA LOCAL BUS MOTHERBOARDS

- 486DX2-50/66 w/128K Cache w/CPU: \$555/\$655
- 486DX2-66 EISA w/128K Cache w/CPU: \$625
- 4B6DX-5D EISA w/128K Cache w/CPU: \$695
- 4B6DX-33/5D w/128K Cache w/CPU: \$445/\$565
- 486SX-25/33 w/128K Cache w/CPU: \$235/\$315
- Genoa VESA Local bus VGA Card w/LM8: \$125
- Pentium P24T upgradeable board add: \$3D
- 256K Cache: add \$30. All Boards use AMI BIOS

ISA MOTHERBOARDS

- 486DX2-50/66 w/128K Cache w/CPU: \$545/\$645
- 486DX-33/5D w/128K Cache w/CPU: \$435/\$555
- 486SX-25/33 w/128K Cache w/CPU: \$225/\$305
- 386SX-25/33 w/OK Cache w/CPU: \$105/\$110
- 386DX-33/40 w/128K Cache w/CPU: \$185/\$185

386/486 UPGRADEABLE BOARDS

- 386DX-33/40 w/128K Cache w/CPU: \$2D5/\$2D5

MOTHERBOARDS ONLY, NO CPU

- VESA 486DX-25/33 w/128K Cache: \$175
- VESA 4B6DX2-5D/66 w/128K Cache: \$175
- 4B6DX-25/33/50 w/128K Cache: \$165
- 3B6DX-33/4D w/128K Cache: \$145
- 386DX-16/20/25 w/OK Cache: \$115

ASSOCIATES COMPUTER SUPPLY CO. INC.
275 West 23rd STREET
RIVERDALE, NEW YORK 10463
(718)543-3364 FAX: (718)548-0343

TOWER CASES

- Size 8" x 27" x 17", 8 Floppy Drives
- MHz LED, Turbo & Reset Switches
- ACS-1DOD Tower Case (2nd Cooling Fan): \$1D5
- ACS-100L Tower Case (Right): \$90
- 25DW/275W/300W Power Supply: \$45/\$55/\$85

MINI TOWER CASE & DESKTOP CASE

- Full Tower Case & 25DW PS: \$125
- Mini Tower Case & 200W PS: \$78
- Full AT Case & 2DOW PS: \$84
- Mini AT Case & 2DDW PS: \$7B

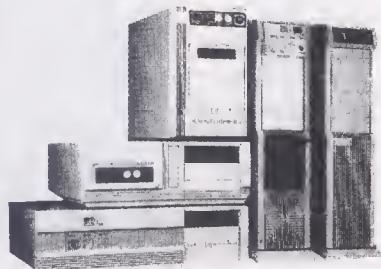
HARD DRIVES & FLOPPY DRIVES

- TEAC 1.2M OR 1.44M FDD: \$53
- Western Digital 34DMB IDE HDD: \$325
- Western Digital 210MB IDE HDD: \$225
- Conner 17DMB IDE HDD: \$2D5
- Seagate 125MB IDE HDD: \$1BD

SIMM's & CPUs & MATH-COs

- 1MB x 9-7D/60ns: \$35/\$38
- 4MB x 9-7D/6Dns: \$137/\$147
- INTEL 80486DX-33/5D CPU: \$305/\$435
- INTEL 80486DX-25/33/40 CPU: \$415/\$515
- ULSI 80387-25/33/40 Math Co: \$65/\$75/\$85

- COD, PREPAYMENT and DISCOVER CARD (2%)
- PO's Accepted from qualified firms and institutions
- One Year Warranty on all parts
- Prices are subject to change without notice
- 10% Restocking fee for non-defective returns



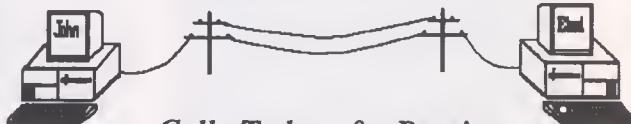
Did you know that Bedford Communications also publishes:

LAPTOP BUYER'S GUIDE & HANDBOOK
PRINTERS BUYER'S GUIDE & HANDBOOK
COMPUTER BUYER'S GUIDE & HANDBOOK

With our combination of Buyer's Guides, your ad can reach hundreds of thousands of serious, high-tech product buyers cost-effectively. No wasted advertising dollars. Call (212) 807-8220 for more information concerning our multi-guide discounts.

The Game Peddler BBS

Commack, N.Y.



*Call Today & Receive
Free Trial Membership!*

(516)493-0186

(516)493-0785

UNITED

COMPUTER

EXPRESS

AST
COMPUTER

PowerExec 4/25SL

Colorplus



- i486SL/25MHz
- 4MB Ram expandable to 32MB
- 9.5" active matrix VGA color display
- 1.44MB floppy drive
- 2 type 2 PCMCIA slots
- 200MB hard drive
- DOS and Windows 3.1 pre-installed
- SmartPoint Trackball

**\$4199
In Stock**

**New York's Largest Notebook
Computer Headquarters**

1•800•448•3738

IN NY STATE 212-247-7606/724 Seventh Ave. N.Y. 10019

Don't miss another issue of

PC Upgrade

Subscribe Today!

Call (800) 877-5487

Recognized as the two best PC-diagnostic tools on the market.

NOW AVAILABLE IN ONE GREAT PACKAGE...

ALL NEW
VER. 5.0!

microSCOPE™
universal diagnostics software

Fully operating system independent
diagnostic software.

PCUPGRADE
UTILITY OF THE MONTH

Recently named as PC Upgrade
Magazine's Utility of the Month.

MICRO-SCOPE Universal Computer Diagnostics was developed to satisfy the expanding need for accurate system diagnosis in the rapidly growing desktop computer market.

- CACHE MEMORY—"Micro Scope" Ver. 5.0 now fully tests cache memory and the cache controller subsystem.

- LOW LEVEL FORMAT—Ability to do factory style initialization of all IDE drives, together with the ability to do factory style low level formatting on all drives, including MFM, RLL, ESDI, SCSI and all IDE drives.

- O/S INDEPENDENT—Does not rely on O/S for diagnostics. Talks to PC on a hardware level regardless of the O/S or CMOS setting.

- TRUE HARDWARE DIAGNOSTICS—Accurate testing of CPU, IRQs, DMA, memory, hard drive, floppy drive, video cards, etc.

- DISPLAY DRIVE TYPE—Reads and displays the actual drive parameters for any drive type automatically.

- CPU DETERMINATION—This capability is necessary for accurate system diagnosis on 386SX, 486DX and 387 and 487 chip implementations. Because each of these specific chips has its own unique instruction set, and therefore cannot be accurately diagnosed with any program which cannot recognize these differences!

- MEMORY TEST—"Micro-Scope" 5.0 has no limitations as to the size of memory it can accurately test. Micro-Scope now also tests VIDEO MEMORY (up to 2 MB)!!

- MEMORY EXAMINE—Displays any physical bit of memory. Very useful for determining memory conflicts. Very useful for determining available memory space.

- BATCH CONTROL—All tests, even destructive, may be selected for testing.

- ERROR LOGGING—Automatically inputs errors during testing to an error log.

- AUTOMAPPING—Automatically bad sector maps errors found on hard disks.

- IRQ DISPLAY—Shows bits enabled in IRQ chip for finding cards that are software driven. (Network, Tape Backup, etc.)

- IRQ CHECK—Talks directly to hardware and shows I/O address and IRQ of devices that respond.

- SECTOR EDITOR—Allows the editing of any sector of floppy or hard disk media (even track 0).

- AND MUCH MORE...We don't have enough space here for everything this software can do!

◆ **AUSTRALIA**—MICRO 2000 Australia, P.O. Box 1777, Wollongong, NSW 2500. Tel: (042) 564446.
◆ **UK**—MICRO 2000 Europe, P.O. Box 2000, Letchworth, Herts, SG6 1TG, England. Tel: +44 462 483483, Fax: +44 462 481484.
◆ **CANADA**—Business Data Systems, 169 Burnside Drive, London, Ontario, Canada N5W 5V5. Tel: (416) 777-2479 or (519) 659-3599.

POST-PROBE™
1ST EVER UNIVERSAL POST CARD FOR ALL PCs!

The only Power-On Self-Test card
you need to debug any "dead" PC!

SERVICE NEWS

THE BUSINESS NEWSPAPER FOR THE COMPUTER SERVICE INDUSTRY

Named as Product of the Month
in the July issue of Service News.

"This is the only card that will function in every system on the market. The documentation is extensive, and not only covers the expected POST Codes for different BIOS versions, but also includes a detailed reference to the bus signals monitored by the card." —Scott Mueller from his globally recognized book,

'Upgrading & Repairing PCs, Second Edition'



- Includes pads for voltmeter to attach for actual voltage testing under load.
- 4 LEDs monitor +5vdc -5vdc +12vdc -12vdc.
- Monitors Hi & Lo clock and OSC cycles to distinguish between clock chip or crystal failure.
- Monitors I/O Write and I/O Read to distinguish between write and read errors.
- Monitors memory write/read to distinguish between address line failures and memory chip failures.
- Monitors ALE for proper CPU/DMA operation.
- Monitors Reset to determine if reset is occurring during POST, indicating short.
- Monitors progress of POST *without* POST codes.
- Reads POST codes from any IBM or compatible that emits POST codes. ISA/EISA/MCA.
- Compatible with Micro Channel computers.
- Dip switch allows easy selection of I/O ports to read.
- Includes tri-state LOGIC PROBE to determine actual chip failures.
- Manual includes chip layouts and detailed POST procedures for all major BIOS's.

This is the perfect package for all repair technicians and self-maintainers.

Call MICRO 2000, Inc. for volume discounts and after sales service!

• 1-800-864-8008 •

1100 E. Broadway, Suite 301
Glendale, California 91205
818-547-0125 • Fax 818-547-0397



Find out about
MicroScope
CLIENT™—a new
tool for technicians!

Free Money.

Due To
Overwhelming
Demand, This
Incredible Offer
Has Been
Extended.

We've Already Reached Our Goal Of One Million Free Copies.
But Now We're Extending Our Offer While Supplies Last!
Call Right Now! Operators Are Standing By: 1-800-FREE-MONEY.

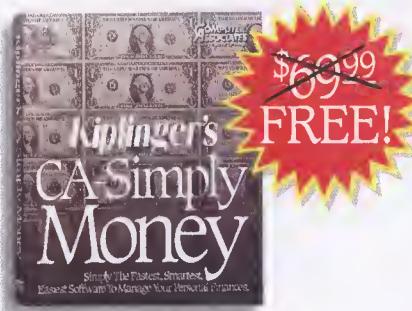
Introducing The Easiest,
Quickest And Smartest Personal
Finance Software In The World.

Is your spending out of control? With Kiplinger's CA-Simply Money, you can get off the financial rollercoaster and on the path to financial freedom. Write checks with a click of the mouse. Balance your checkbook. Create a monthly budget and control your expenses. What used to take hours now takes just minutes.

It's that quick and easy. And it's just plain smart. Kiplinger's CA-Simply Money puts you in total control of all your finances so you can make smarter decisions.



"Kiplinger's CA-Simply Money makes everything simple and easy. For the very first time, I'm in total control of all of my finances."



A Personal Financial Advisor
Filled With Expert Advice
From Kiplinger.

For more than 70 years, Kiplinger has been the first name in personal finance. Now their expert financial and tax advice will be



right at your
fingertips.

To prove how simple and easy Kiplinger's CA-Simply Money is, we're giving away millions of copies for FREE.

That's right. You can get this \$69.99 product FREE.

But you have to act fast. Pick up the phone right now and order your FREE copy of Kiplinger's CA-Simply Money today.

New Kiplinger's
CA-Simply Money Covers
Simply Everything:

- Kiplinger's Financial Advisor
- Checking and Savings
- Investment Tracking
- Tax Reports
- Automatic Budgeting
- Computerized Check Writing
- Credit Cards
- IRAs/401(k)s
- Modern Stock Update
- Mortgages
- Financial Calculators
- Memorized Transactions

For A FREE Copy Of
Kiplinger's CA-Simply Money
Call: 1-800-FREE-MONEY
Dept. J5002

**COMPUTER
ASSOCIATES**
Software superior by design.

Kiplinger's CA-Simply Money

*There is a nonrefundable \$6.95 shipping and handling charge. Have your credit card ready: Visa, Mastercard, AmEx, Discover accepted. One copy per household. Only available in the US. IBM PC or PC compatible with Windows 3.1 and minimum 2Mb RAM required. This offer is subject to availability. Computer Associates reserves the right to end the offer at any time. © Computer Associates International, Inc., Islandia, NY 11788-7000. Kiplinger's is a trademark of The Kiplinger Washington Editors, Inc. All product names referenced herein are trademarks of their respective companies.